SCIENTIFIC AMERICAN

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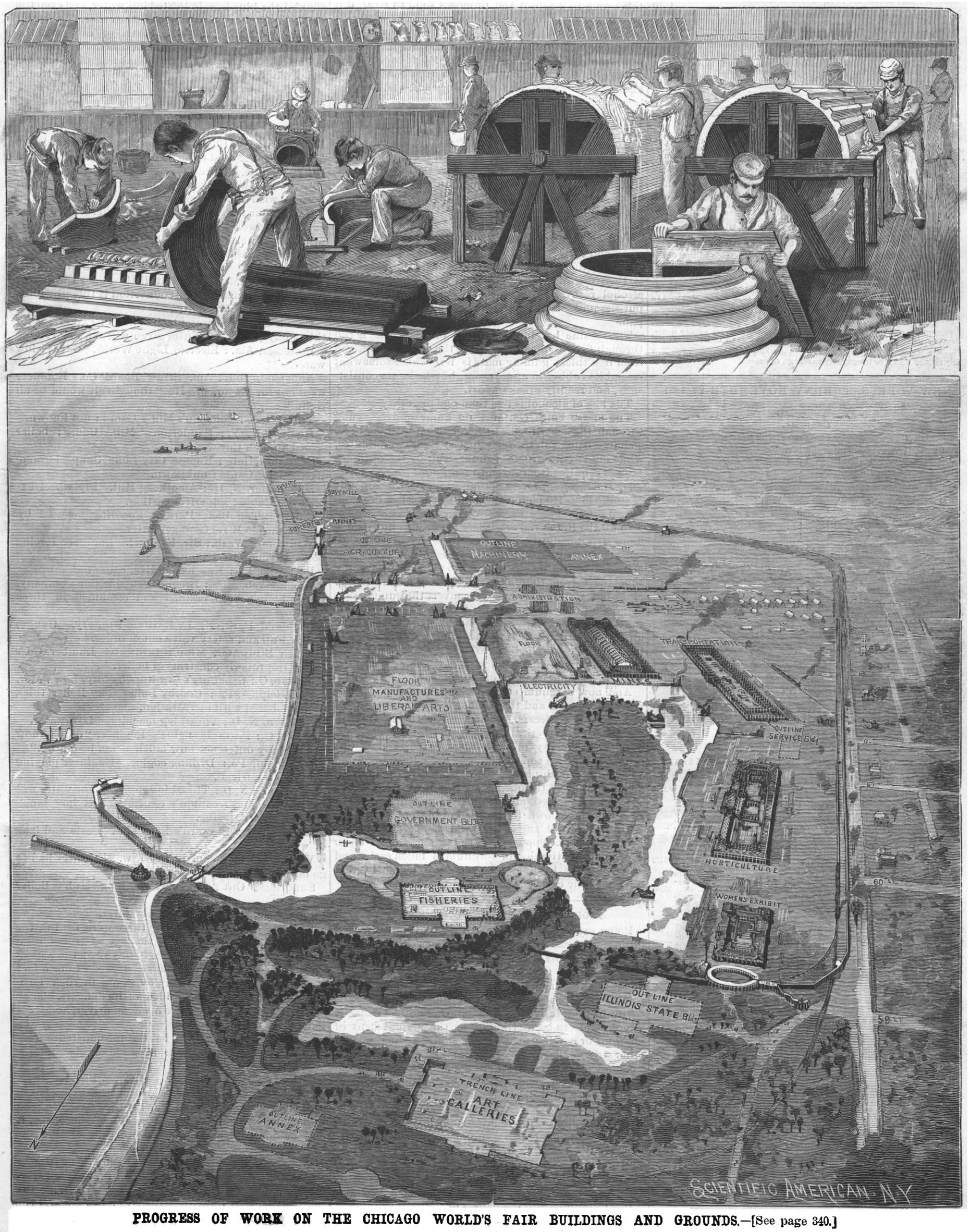

PROGRESS OF WORK ON THE CHICAGO WORLD'S FAIR BUILDINGS AND GROUNDS.—[See page 340.]

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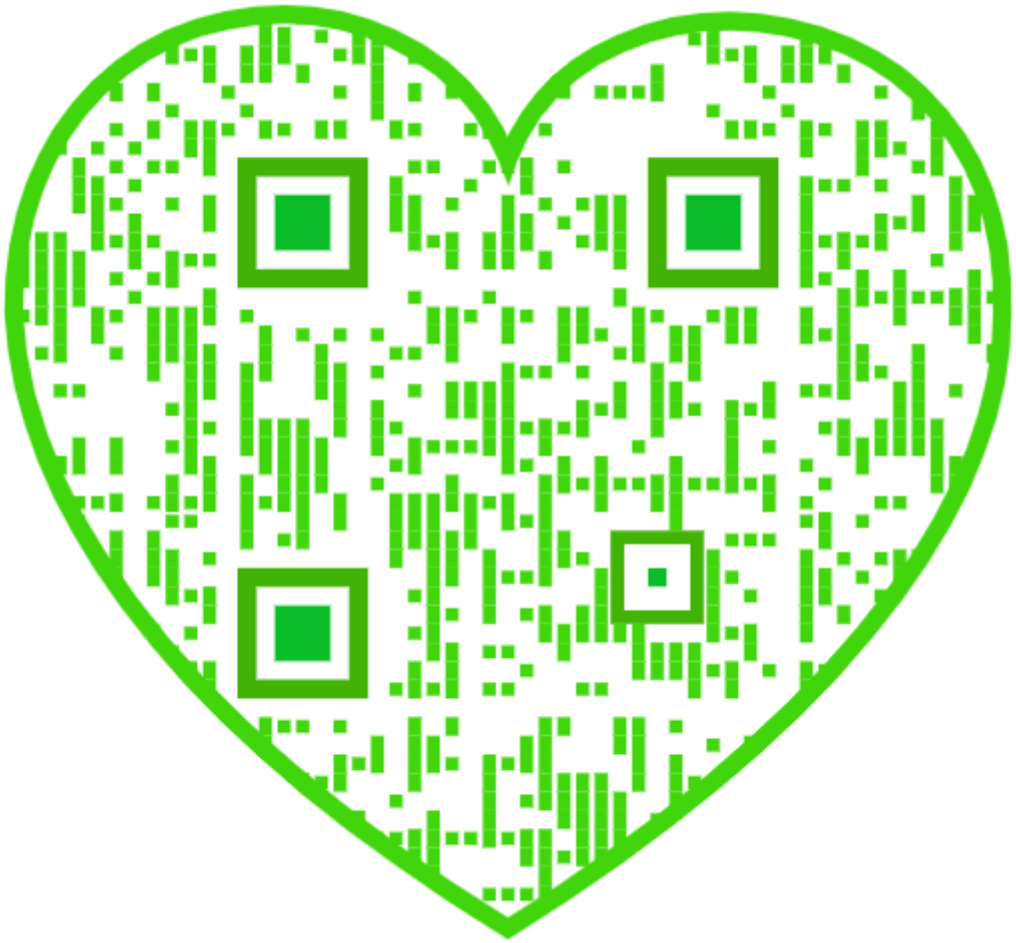

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PLATES FOR SECONDARY BATTERIES.

A solution is made by boiling litharge in a very concentrated solution of caustic soda and potash. A lead plate boiled in this solution will receive a coating of spongy lead ½ inch in thickness. This can be pressed down so as to occupy only one one-hundredth of an inch. A plate thus prepared yields readily to the forming process. This method is due to Edison.

IMPORTANT IMPROVEMENTS IN SORGHUM SUGAR MANUFACTURE.

By the recent introduction of the alcohol process in the manufacture of sugar from sorghum, the industry takes on a new aspect and promises soon to rival if it does not surpass in value the cane and the beet root products. H. W. Wiley, director of the government surghum sugar station at Medicine Lodge, Kansas, reports the yield of first sugar to be 150 pounds per ton of the plant, which latter costs $2 to $2.50 per ton, against $4 to $5 per ton for beets or cane, yielding the same amount of first sugar.

The Louisiana *Planter* says: The process, until the semi-sirup is ready for the strike pan, is the same as in the ordinary sorghum mill. After the juice has been evaporated to a semi-sirup, ready for graining in the strike pan, it is drawn off into large tanks and mixed with an equal volume of alcohol, a pipe at the bottom of the tank conveys a current of air through the mixture, and the sirup and alcohol are thoroughly mixed. It is then allowed to stand about twelve hours.

The alcohol combines with the impurities in the sirup and a mass of gummy substances is precipitated to the bottom. The clear mixture of sirup and alcohol is then drawn into the distilling column and the alcohol recovered. The sirup, being freed from impurities and alcohol, is then conveyed to the strike pan.

The residue left in the bottom of the tanks is run through filter presses, and after the sirup is obtained from it a thick, gummy mass is left which somewhat resembles rubber in appearance, but lacks its consistency, and readily breaks apart.

The loss of alcohol is less than one per cent.

The masse cuite contains no gums and is swung through the centrifugals in a remarkably short time, a charge being run through in less than two minutes, while masse cuite from sorghum sirup by the ordinary process requires from seven to ten minutes.

By the alcohol process actual sugar to the amount of from 148 to 160 pounds per ton of cane has been obtained.

In all the industrial arts there is perhaps nowhere a more striking illustration of the ability of science to remove difficulties than in this case of sorghum sugar manufacture. Chemicals failed to remove the gummy substances from the juice, mechanical means failed. Mark how simple the remedy—convert the gummy substances into alcohol, and use the alcohol to separate the gummy substances. It is simply to make the gummy substances remove the gummy substances. It is simply to cause the juice to clarify the juice, the impurities to remove the impurities. There is nothing simpler, except the wand of a magician.

And now sorghum sugar manufacture, having the diffusion process and the alcohol process, enters a new era, an era of success. It has now a business basis, instead of a theoretical basis.

There are many millions of acres of land in the Southwest whose soil and climate are admirably fitted to produce sorghum cane containing 246 pounds of sugar in a ton of trimmed cane, that is cane cleaned of leaves and of seed, and of this 246 pounds of sugar, 150 pounds is known to be easily obtainable; so that with the second sugar the total yield will not fall much short of 200 pounds of sugar per ton of clean cane. The cultivation of sorghum is much easier and less expensive, in the Southwest, than the cultivation of sugar cane or of sugar beets.

POOR ENGINEERS AND GOOD BOILERS.

Boiler explosions are constantly taking place which ordinary precautions would have served to prevent. If any one doubts this let him investigate the causes of such disasters. On an average, the serious ones occur about twenty times a month, at least this has been the rate for the past two years, during which time the writer has carefully noted them. One potent cause is undoubtedly to be attributed to the employment of ignorant or careless men in the engine room, and another to the parsimony of some steam users, who "cannot afford" to get new boilers, though the old ones have been rendered dangerous by ill usage; perhaps they were only cheap tank iron affairs when first set in.

A few, happily the minimum, come from causes which the most painstaking manufacture and the most skillful handling would not always avail to prevent, for there are conditions of generation and expansion of gases within boiler shells which even at this late day are not thoroughly understood.

Let us inquire into the causes of some of the recent explosions. There were twenty-five serious ones between October 15 and November 15. In the case of the disaster in the boiler house of the Louisville (Ky.) Electric Power Co., the exploding boiler was connected with another by a large steam drum, so that when one had a certain pressure, the other had the same. Each had an independent feed pipe entering at the top, and also separate gauge cocks and glass water gauges. They were connected at the bottom with a two inch equalizing pipe. It was shown conclusively that there was plenty of water in one, and none in the exploded boiler. Close inspection of the inner sides of the plates showed this. The feed valve had become closed and the equalizing pipe stopped up by scale and sediment. The indications of the back head and the flue, which showed the blue line, indicated low water, and even the engineer admitted that that was the cause. The result of this explosion was the death of one man, the wounding of several others, and a disastrous fire.

The engineer trusted to the equalizing pipe, and did not even trouble himself to keep his boilers free of scale and to watch his gauges. Even his brother engineers in Louisville condemned him in a special meeting.

A somewhat similar case occurred at the Enterprise Mills, St. Jacob, Ill. The boiler that exploded let go along the horizontal seam of the first sheet, just below the water line, one flue was collapsed its full length. There were two boilers set in battery, connected at bottom with mud drum with seven inch legs, and on top with four inch pipe only. The boiler that did not explode showed no signs of low water, while in the other they were unmistakable. This seems to have been a clear case of driving the water from one boiler into the other. There had been a big fire under the one that exploded, and but little under the other. That and the small steam connection is thought to be sufficient to account for it.

Here is a fairly representative list of explosions for thirty days, with the causes given where known:

Bessemer, Ala.: Electric Light Works. Cause: low water.

Anderson, Ind.: Am. Straw Board Co. Engineer went out for his lunch. He "thought it would be all right."

Tifton, Ind.: Coleman's Mill. Cause: not known.

Medina, N. Y.: Sanderson's Mill. Cause: boiler scaled an inch thick.

St. Paul, Minn.: Kansas City Lime Shops, locomotive boiler. Cause: unknown.

Manchester, N. H.: Amoskeag Mill. Fly wheel exploded. Cause: imperfect casting.

Chicago: Tug boat Parker. Foaming, caused by using Chicago River (sewage) water.

Whitcomb, Wash.: Str. Evangel. Engineer forcing boiler beyond safety limit.

Pottsville, Pa.: New locomotive, cause unknown.

Brookhaven, Miss.: Brookhaven Machine Company. Boiler hadn't been cleaned and examined in three months.

Highland Park, N. J.: Raritan Brewery. Gauges stopped up and safety valve out of order.

South Stillwater, Minn.: Stillwater Lumber Co.'s Mill. Improperly constructed boiler.

Marion, O.: Schaffner's furniture factory. Low water.

Philadelphia, Pa.: Conroy Boiler Co. Boiler thick and cumbered with incrustation.

Sanborn, N. D.: Thrashing machine. Low water.

Tokio, O.: Portable engine. Engineer "didn't know it made any difference how much steam he got up."

McDonald, Pa.: Drilling engine. Engineer playing cards with a friend.

Eckelson's, N. D.: Thrashing engine. The water was low, and engineer couldn't remember just how much steam he was carrying.

Kildare, Tex.: Steward's Saw Mill. Scale and lack of water.

Van Wert, O.: Steam picket saw. Engineer had to go out for his lunch.

Sundridge, Ont.; Tookey's Planing Mill. Boiler worn out.

Venedocia, O.: Saw mill. Low water.

In most of the cases where there were deaths, the coroner's inquiry brought out the fact of gross incompetence. Indeed, the evidence in many of these cases is calculated to amaze the reader. It seems to be a fact that there are those who employ steam in their business without the smallest idea of its dangers. They hire an engineer as they hire a wagon driver, and trust to luck for the rest.

In some sections the laws bar out incompetence from the engine room, and such laws should be in force everywhere.

The Stationary Engineers, of Louisville, Ky., who met recently to consider the cause of the explosion in that city, declared it as their belief that "engineers as well as boilers should be inspected." A sentiment, it may be said, which does credit to their intelligence.

To prepare transfer paper, take some thin post or tissue paper, rub the surface well with black lead, vermilion, red chalk or any coloring matter. Wipe the preparation well off with a piece of clean rag and the paper will be ready for use.

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POSITION OF THE PLANETS IN DECEMBER.

MERCURY

is evening star until the 28th, and then morning star. He is the most active member of the solar family during the month, playing a part on no less than ten occasions. We call attention to the most important. He is in conjunction with Venus on the 5th, at 10 h. 3 m. A. M., being 1° 15′ south. The planets are invisible at the time of conjunction, the event occurring in the daylight, but they will be visible, on the evening of the 5th, to bright-eyed observers. They set on that evening a little more than an hour after the sun, and are about 2° south of the sunset point. The great southern declination of both planets is, however, unfavorable for northern observers. Mercury reaches his greatest eastern elongation on the 11th, at 10 h. 12 m. A. M., when he is 20° 36′ east of the sun. He is then, and for a week before and after, visible to the naked eye, if the weather conditions are favorable, setting at elongation, about an hour and a quarter after the sun. Mercury is in inferior conjunction with the sun on the 28th, at 4 h. 53 m. P. M., when, passing between the earth and the sun, he closes his course as evening star.

The new moon of the 1st is in close conjunction with Mercury on the 2d, at 8 h. 39 m. P. M., being 30′ south. The waning moon, a few hours before her change, is in conjunction with Mercury for the second time in the month, on the 30th, at 1 h. 29 m. P. M., being 6° 6′ south.

The right ascension of Mercury on the 1st is 17 h. 49 m., his declination is 25° 49′ south, his diameter is 5″.6, and he is in the constellation Sagittarius.

Mercury sets on the 1st at 5 h. 26 m. P. M. On the 31st he rises at 6 h. 37 m. A. M.

VENUS

is evening star. It is still the day of small things on her calendar, but before the month closes she will be far enough east of the sun to be recognized by every observer who turns his gaze to the southwestern sky soon after sunset. This radiant evening star sets an hour and a half later than the sun on the middle of the month and two hours later at its close.

The new moon of the 1st is in conjunction with Venus on the 2d, at 9 h. 13 m. P. M., being 1° 54′ south.

The right ascension of Venus on the 1st is 17 h. 51 m., her declination is 24° 24′ south, her diameter is 10″.8, and she is in the constellation Sagittarius.

Venus sets on the 1st at 5 h. 34 m. P. M. On the 31st she sets at 6 h. 33 m. P. M.

JUPITER

is evening star. An interesting event occurs in his December course. He is in quadrature, or 90° east of the sun, on the 1st, at 5 h. 2 m. P. M. He is then on the meridian near sunset and sets about midnight. He is resplendent in the western sky, and in fine position for telescopic observation. A new red spot has been discovered on Jupiter's disk, having been first seen by Mr. Stanley Williams in 1889. It is not as large as the famous red spot that appeared in 1878. It is in the same latitude as the dark belt south of the great red spot. A fresh subject for investigation and speculation is now presented to the men of science, who are as far from comprehending the meaning of the mighty changes going on in the Jovian domain as they were thirteen years ago, when the great red spot first appeared.

The moon is in conjunction with Jupiter on the 7th, the day before her first quarter, at 10 h. 50 m. P. M., being 4° 12′ south.

The right ascension of Jupiter on the 1st is 22 h. 46 m., his declination is 9° 12′ south, his diameter is 38″.8, and he is in the constellation Aquarius.

Jupiter sets on the 1st at 11 h. 28 m. P. M. On the 31st he sets at 9 h. 51 m. A. M.

SATURN

is morning star. He is in quadrature, or 90° west of the sun, on the 21st at 6 h. P. M., when he rises about midnight. Observers, who have telescopes, will find it most interesting to watch the reappearance of the rings, as they gradually change from threads of silver to the larger proportions that make Saturn the marvel of the heavens.

The moon is in conjunction with Saturn the day before her last quarter, on the 22d, at 8 h. 10 m. P. M., being 2° 21′ north.

The right ascension of Saturn on the 1st is 11 h. 59 m., his declination is 2° 24′ north, his diameter is 16″, and he is in the constellation Virgo.

Saturn rises on the 1st at 1 h. 3 m. A. M. On the 31st he rises at 11 h. 11 m. P. M.

MARS

is morning star. He makes a close conjunction with Uranus on the 15th at 4 h. 58 m. A. M., being 29′ north. The planets rise on the 15th about a quarter after 3 o'clock, and a good opera glass or a small telescope will bring them to view as they hang side by side in the morning sky, the distance between them being a little less than the diameter of the moon.

The moon makes a close conjunction with Mars, four days before her change, on the 26th, at 9 h. 56 m. A. M., being 25′ north. The waning moon and the ruddy planet will be near together as they approach conjunction on the morning of the 26th.

The right ascension of Mars on the 1st is 13 h. 36 m., his declination is 9° 0′ south, his diameter is 4″.6, and he is in the constellation Virgo.

Mars rises on the 1st at 3 h. 23 m. A. M. On the 31st he rises at 3 h. 2 m. A. M.

NEPTUNE

is evening star. He is in excellent position for observation with opera glass or telescope, being visible nearly the whole night. He must be looked for in the early evening, in the east, a little northwest of Aldebaran.

The right ascension of Neptune on the 1st is 4 h. 24 m., his declination is 19° 58′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune sets on the 1st at 6 h. 52 m. A. M. On the 31st he sets at 4 h. 51 m. A. M.

URANUS

is morning star. His right ascension on the 1st is 14 h. 7 m., his declination is 12° 22′ south, his diameter is 3″.4, and he is in the constellation Virgo.

Uranus rises on the 1st at 4 h. 2 m. A. M. On the 31st he rises at 2 h. 13 m. A. M.

Mercury, Mars, Saturn, and Uranus are morning stars at the close of the month. Venus, Jupiter, and Neptune are evening stars.

How to Make a Good Floor.

Nothing attracts the attention of a person wishing to rent or purchase a dwelling, store, or office so quickly as a handsome, well-laid floor, and a few suggestions on the subject, though not new, may not be out of place. The best floor for the least money can be made of yellow pine, if the material is carefully selected and properly laid.

First, select edge grain yellow pine, not too "fat," clear of pitch, knots, sap, and splits. See that it is thoroughly seasoned, and that the tongues and grooves exactly match, so that, when laid, the upper surfaces of each board are on a level. This is an important feature often overlooked, and planing mill operatives frequently get careless in adjusting the tonguing and grooving bits. If the edge of a flooring board, especially the grooved edge, is higher than the edge of the next board, no amount of mechanical ingenuity can make a neat floor of them. The upper part of the groove will continue to curl upward as long as the floor lasts.

Supposing, of course, the sleepers, or joists are properly placed the right distance apart, and their upper edges precisely on a level, and securely braced, the most important part of the job is to "lay" the flooring correctly. This part of the work is never, or very rarely ever, done nowadays. The system in vogue with carpenters of this day, of laying one board at a time, and "blind nailing," is the most glaring fraud practiced in any trade. They drive the tongue of the board into the groove of the preceding one, by pounding on the grooved edge with a naked hammer, making indentations that let in the cold air or noxious gases, if it is a bottom floor, and then nail it in place by driving a six-penny nail at an angle of about 50° in the groove. An awkward blow or two chips off the upper part of the groove, and the last blow, designed to sink the nail head out of the way of the next tongue, splits the lower part of the groove to splinters, leaving an unsightly opening. Such nailing does not fasten the flooring to the sleepers, and the slanting nails very often wedge the board up so that it does not bear on the sleeper. We would rather have our flooring in the tree standing in the woods than put down that way.

The proper plan is to begin on one side of the room, lay one course of boards with the tongue next to, and neatly fitted to, the wall (or studding, if a frame house), and be sure the boards are laid perfectly straight from end to end of the room and square with the wall. Then nail this course firmly to the sleepers, through and through, one nail near each edge of the board on every sleeper, and you are ready to begin to lay a floor. Next, fit the ends and lay down four or six courses of boards (owing to their width). If the boards differ widely in color, as is often the case in pine, do not lay two of a widely different color side by side, but arrange them so that the deep colors will tone off into the lighter ones gradually. Push the tongues into the grooves as close as possible, without pounding with a hammer, or, if pounding is necessary, take a narrow, short piece of flooring, put the tongue in the groove of the outer board, and pound gently on the piece, never on the flooring board. Next, adjust your clamps on every third sleeper and at every end joint, and drive the floor firmly together by means of wedges. Drive the wedges gently at the start, and each one equally till the joints all fill up snugly, and then stop, for, if driven too tight, the floor will spring up. Never wedge directly against the edge of the flooring board, but have a short strip with a tongue on it between the wedge and the board, so as to leave no bruises. Then fasten the floor to the sleepers by driving a flat-headed steel wire nail of suitable size, one inch from either edge of every board, straight down into each sleeper. At the end joints smaller nails may be used, two nails in board near the edges, and as far from the ends as the thickness of the sleeper will permit. Proceed in this manner until the floor is completed, and you will have a floor that will remain tight and look well until worn out.

Such minute directions, for so common and simple a job, sound silly, but are justifiable from the fact that there are so many alleged carpenters who either do not know how or are too lazy to lay a floor properly—*The Builders' Gazette.*

Durability of Redwood.

The Santa Barbara authorities recently investigated the lasting qualities of redwood, in order to decide whether to use redwood or stone for a bulkhead for the proposed esplanade.

The following are the questions and answers received in regard to Santa Cruz redwood:

From E. L. Van Kleck: How long will this redwood last under ground or in salt water? Answer—Without any decay at all, it will last 25 years. Some will last much longer; 6 × 6 posts have been removed perfectly sound, after being in the ground over 30 years.

How long would it remain sufficiently sound to hold spikes, or until one-third of a 6 × 8 timber would decay, while constantly wet with salt water? Answer—In some cases, 30 years. I am told by some that the kind of lumber described will last forever.

How long would 6 × 8 piles last, where they are constantly wet with salt water to four or five feet above ground? Answer—Salt water being a good preservative, I should think they would last 35 years.

How long would it remain sound in the ground where there is salt water, or where it would be alternately wet and dry? Answer—Thirty years.

How long would 2-inch plank last in a retaining wall, with earth more or less damp or wet on one side, and the other side dry, or exposed to the weather? Answer—Dampness does not seem to have any decaying effect on redwood. I should say such plank would last 20 years. All of this without any preservation. Coal tar as a preservative, applied hot, is as good as any I know.

From Charles Pierce: I have known some heavy black heart Santa Cruz redwood to lie under ground as long as 30 years without decay. This was in the case of a piece of 6 × 6 redwood used by myself for a gate post on my own premises.

Russell Heath: I have fence posts of redwood on my farm, the same having been in the ground 32 years, and they are sound, free from decay.

John P. Stearns: I know of a timber of Santa Cruz redwood that was 41 years under and in moist ground, and remained sound, free from decay.

G. P. Tebbetts: I know of common redwood posts that have been set in Santa Barbara over 25 years, and are sound to-day.

Insufficiency of the Marine Subsidy.

The International Navigation Company has decided not to compete for the American mail contract under the Postal Subsidy act, in accordance with which bids have been opened by the Postmaster-General. The president of the company, Mr. Griscom, says: "It was deemed inadvisable to enter into competition, because, under the rates given by the act, a transatlantic line of steamers, built in America and sailing under the American flag, would not pay. The establishment of a line of ships built in the United States and flying the American flag would cost too much. We doubt whether ships can be built in America as cheaply as abroad. The act allows but $4 per mile for a first class 20 knot liner for carrying the mails on the outward voyage only. No provision is made for the home voyage, because the government believes that American built vessels on the lines established by the act could secure the return mails at a remunerative figure, This supposition betrays want of familiarity with the subject. In the first place, foreign nations are very likely to discriminate in favor of vessels flying their own flag, and would not send the mails on board American ships unless the letters were especially directed to be sent that way, and not always then. That has been repeatedly demonstrated. In the second place, under the provisions of the act requiring that the vessels shall be of peculiar construction, with a view to their conversion into auxiliary cruisers, which must be approved by the Secretary of the Navy, the cost of building, with the requirement that they shall be run during the winter season, when there is no passenger traffic, would be too burdensome."

Steam Fire Pumps.

According to a circular recently issued by the Associated Factory Mutual Insurance Companies of New England, very few pumps are found upon inspection to meet the requirements of an efficient fire service. Of two or three thousand tested by the companies' inspectors each year, a great number prove to be defective; some cannot be started promptly, and some are incapable of delivering anywhere near their alleged or rated capacity without violent hammering. These tests have made it plainly evident that an improvement in the construction and installation of fire pumps was greatly needed.

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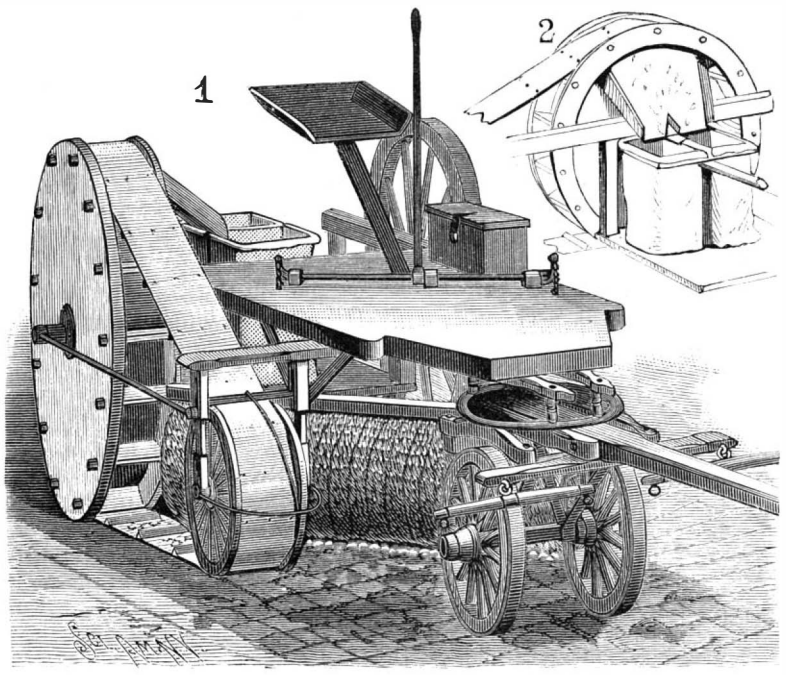
A NEW STREET CLEANER.

In the improved street sweeper shown in the annexed engraving the usual diagonal broom is used, but instead of throwing the sweepings to one side of the street, forming windrows to be taken up by hand, the machine carries an endless belt on which the sweepings are delivered. One of the driving wheels is similar in construction to the paddle wheel of a steamboat, and the endless belt is carried on the edges of the paddles, entirely inclosing the space between the two rims of the wheel. The edges of the paddles are not allowed to come quite to the surface of the rims, so that the belt is protected from actual contact with the ground at the bottom of the wheel. The endless belt passes round a guide wheel in front of the drive wheel, which is arranged in such relation to the drive wheel as to permit the lower portion of the belt lying between these wheels to lie upon the ground, but without dragging; it is simply laid down by one wheel and taken up by the other. The sweepings being received upon this part of the belt are carried up between the paddles to the top of the wheel, where they fall toward the center, and are carried by a chute into bags (Fig. 2), and are delivered by an elevator to a cart drawn along with and behind the machine. This arrangement, which is extremely simple, adds but a trifle to the size of the usual machine, and does not increase the weight more than 250 to 300 pounds. All the parts of the machine are constructed with a view to durability.



THE CHARLTON STREET CLEANER.

The belt is three-ply cotton belting; it is very strong and will last a long time, and when worn out can be replaced at a trifling expense.

The machine is drawn by two horses, and is in striking contrast to the cumbrous devices heretofore proposed for gathering up sweepings from the street. It can be operated with as much ease as the ordinary sweeper, and cleans close to the curbstone. There is absolutely nothing that drags upon the pavement.

In streets in which the traffic is not great the material is received into bags, eight of which, holding three bushels each, can be carried on the machine. When these are filled, they are set off on to the curbstone to be removed by carts. Strong bags suitable for this purpose can be had in unlimited numbers for 7 cents each, and they can be used many times over. In these bags the sweepings have a commercial value.

Where the traffic is greater and the bulk of sweepings larger a narrow carrier is substituted in the place of the bags, and the sweepings falling upon this are conveyed into a cart following the machine.

Unlike the usual sweeper this can be used in the day-time, as there is no windrow of dirt left upon the street to be scattered by passing vehicles.

Apparently this device solves the problem of economical street cleaning.

The manufacturer is George B. Marx, Inventor's Industrial Works, 412 East 13th Street, New York.

The Aroma of Wine.

At a recent meeting of the Paris Academy of Sciences, M. Rommier read a paper on the yeast of wine—the bouquet, or aroma, of the wine made from grapes of the same species but grown in different districts being quite distinct. The characteristic bouquet seems to be due to the district, and wine from shifted vines or cuttings does not necessarily possess the special flavor of the original when planted in other districts. It is well known that the best wines are produced from grapes raised on volcanic soils.

COAL HANDLING DEVICES.

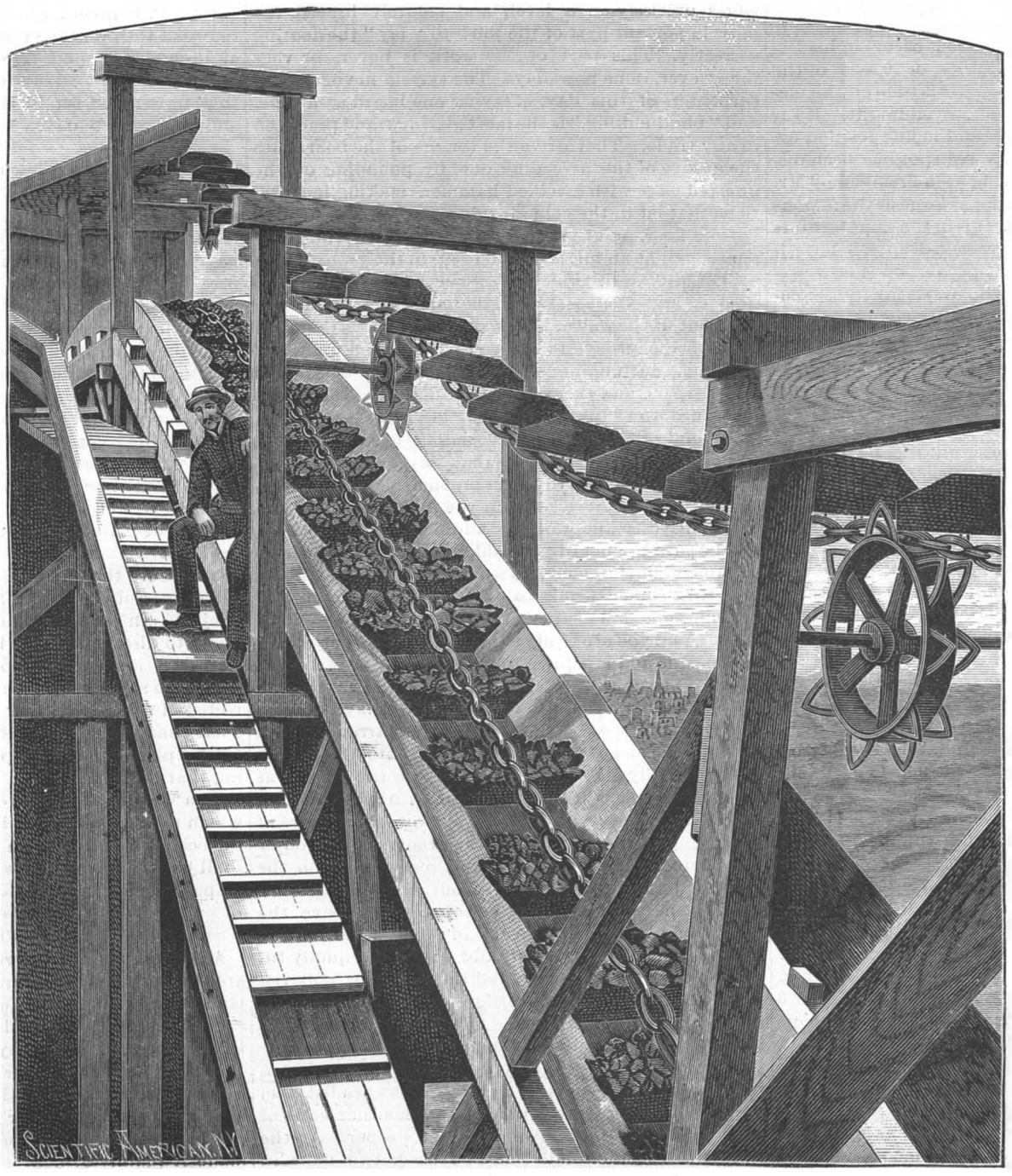
In a recent article in the *Railway Review* a description is given of the various devices used in handling coal at the coaling station of the Chicago and West Michigan Railway. We make the following abstract:

The distinctive feature of the plant is the conveyor, and this is of the kind which has become standard throughout Pennsylvania and forms the basis of the immense coal storage plants, whose capacities range from 100,000 to 1,000,000 tons each, recently built for some of those Eastern roads which handle coal in such large quantities. The coal in this form of conveyor is drawn along in a smooth steel trough by peculiarly curved scrapers attached to the conveyor chain. This chain is what is known as the Dodge cable chain, the essential feature of which is that the links, instead of bearing directly upon each other and thus wearing out very rapidly, have malleable iron wearing blocks interposed at each articulation. These blocks not only take the wear but also fill in the end of the link in such a manner as to keep it in shape—a matter of no small importance. The scrapers which are attached to this chain are of steel plate, and are of somewhat peculiar shape, these peculiarities being the result of a long experience, and which have been found essential to the success of this scraper. The curved shape given to the scraper makes it most effective in carrying the coal along and entirely obviates the noise which would occur if the plate was perfectly flat.

The operation of the plant is briefly as follows: The coal is shoveled from the cars in which it arrives directly to the conveyor at the bottom of the incline, which carries it up and deposits into any one of a number of chutes, according to the position of the discharge gates. Each gate serves two chutes, and the coal is directed into one or the other of these two by the deflecting plates, each of which is controlled by a vertical shaft, the end of which is bent to form a lever. The chutes are of the well known Clifton form, and hold varying amounts up to five tons.

They automatically and instantly deliver their contents to the tender when the balanced apron is pulled down by the fireman on the engine. If, when the coal is being delivered from the cars, the chutes happen to be full, the contents of the cars, instead of being sent to the conveyor, are shoveled into the storage bin, from which they can be drawn by gravity to the conveyor. By extending the conveyor forty or more chutes could be equally well used should the number of locomotives require it. The conveyor fed to its full capacity will handle about 120 tons per hour Owing to its practically noiseless operation caused by the peculiar curving of the scrapers it is well fitted for use in cities. The cost of conveying the coal is less than one cent per ton, which makes the total cost of placing it on the locomotive below six cents, about five cents per ton being paid for shoveling it from the car. If the coal could be delivered on the track from cars with hopper bottoms, the total cost of handling the coal would be reduced to about two cents per ton. With the plant at New Buffalo the services of two men working at intervals during the day are required, three men night and day being necessary prior to its installation. The conveyor is driven by a single 1½ inch manila rope, a form of transmission coming rapidly into use.

The great saving in cost which is effected by the use of a conveyor destines it to supplant past methods in the handling of coal at locomotive coaling stations. The crane and buckets are very slow and make the expense of handling the coal from 17 to 20 cents per ton. In addition to this, it may be said in general that the amount of space required for inclined tracks, etc., is generally much more than is required for a conveyor. A number of plants similar to the one here illustrated have been put in by this same company on roads where the locomotives burn anthracite coal. In some cases other conveyors were provided for removing the ashes from the ash pits and supplying sand to the engines.



STANDARD COAL CONVEYOR.

Vaccination for the Relief of Whooping-cough.

Dr. Emile Müller reports in the *Gazette Médicale de Strasbourg*, No. 7, 1891, the case of a young child suffering from pertussis, in whom a cure was made by means of vaccination. Dr. Cachazo (*Wiener Medizinische Blatter*, October 15, 1890) had previously noted the favorable influence of inoculation with vaccine material in a case of whooping-cough under his care, and subsequently employed the method in four other cases with great success.

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A PIPE DIE STOCK FOR VARIOUS SIZES OF PIPE.

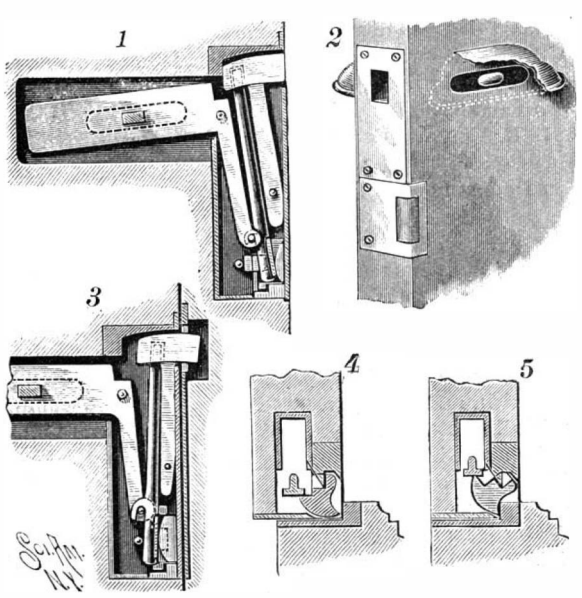
This new die stock has recently been placed on the market by the Wiley & Russell Manufacturing Co., of Greenfield, Mass. The stock which we illustrate holds five sizes of pipe, ¼, ⅜, ½, ¾ and 1 inch, and is always ready without any picking up and fitting. The five sizes of dies are so set in the circle that the hole

GALLOWAY'S "LIGHTNING" DIE STOCK FOR PIPE.

serving as a guide appears directly opposite each, giving a good, true bearing and insuring a perfect thread. The dies are made adjustable to allow for irregular fittings and for wear, and are in two parts, so that they may be taken apart to be ground when dull. The guide holes are bushed to next size larger for convenience in cutting nipples and to enable them to be kept in repair.

AN IMPROVED SPRINGLESS LOCK.

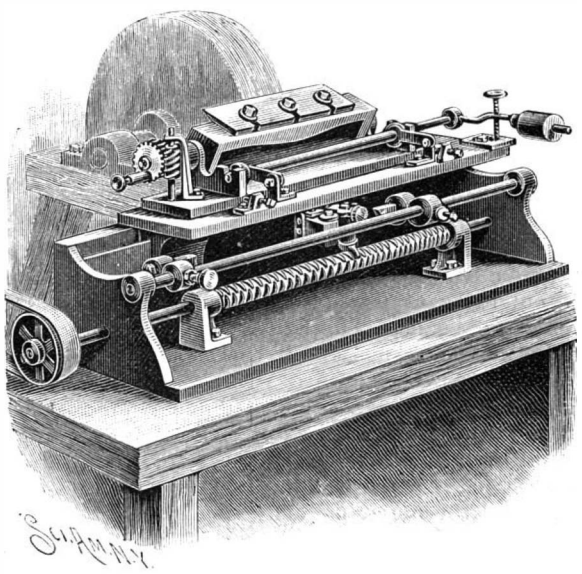
The illustration represents a lock having a gravity bolt, which, when the door is shut, will automatically move outward to lock the door, and when the bolt is drawn backward to open the door will remain in the lock casing until the door is again closed. This improvement has been patented by Mr. Thomas C. Mace, of Cameron, Mo. Fig. 1 is a central vertical section, the bolt being back in the casing, Fig. 3 showing the bolt thrown outward to the locked position. Fig. 2 shows the lock attached to a door, and Figs. 4 and 5 are transverse sections of the lower portion of the lock. The bolt of the lock is somewhat segmental in shape and has a shank pivoted low down in the casing, while in an opening in the back of the casing, to the rear of the bolt, is pivoted the inner end of a weight having a downwardly extending arm, and forming a weighted bell crank lever. The arm is bifurcated at its lower end, and through the bifurcation passes a hook extension of a shifting lever, the two being connected by a pin, and the shifting lever at its upper end entering a recess in the under face of the bolt. At the lower end of the casing is inserted an angle plate within which is pivoted a trip lever, as shown in Figs. 4 and 5, the lever consisting of a specially formed block having lugs which enter cavities in the angle plate, and a cylindrical surface closing a vertical opening in the corner of the angle plate. The lower end of the shifting lever has a T-shaped plate adapted to engage a shoulder on the trip lever, and on the striking plate fitted in the jamb of the door is a lug which, as the door is closed, engages the surface of the trip lever to force inward the lower end of the shifting lever, bringing the weight almost in a horizontal position, and throwing the bolt, as shown in Fig. 3. A projection on the weight extends through a mortise in the side of the door, under a suitable hood, as shown in Fig. 2, and by a slight pressure on this knob the weight is again moved to change the position of the shifting lever and withdraw the bolt. As will be seen, this lock is entirely without springs, and its parts are designed to move with a minimum of friction.



MACE'S LATCH, OR SPRINGLESS LOCK.

AN EFFICIENT KNIFE-GRINDING MACHINE.

The machine shown is especially designed for grinding knives for cutters of various descriptions, and permits of readily examining the work as it progresses without disturbing the adjustment. It has been patented by Mr. Eugene J. Wheeler, of Millington, Tenn. On the main driving shaft is a right and left hand screw thread engaged by a shoe on the lower end of a shaft turning in a bracket secured to a longitudinally sliding table, the carriage with the cutter-head carrying the knife to be ground sliding in guideways on the table. When the shoe stands in one direction it engages one of the screw-threads to move the table toward one end of the frame, and when the shoe is turned to point oppositely it engages the other thread to carry the table toward the other end of the frame, whereby the knife will be carried forward and backward over the grinding wheel. The shaft turning the direction of the shoe may be shifted by hand by means of a handle, not shown, but this is effected automatically by an arm on the shaft engaging spring-pressed blocks held in collars on a longitudinal rod, the collars being placed where desired on the rod, and the blocks being held yieldingly in the collars, so that the shoe will readily change its position at the crossing of the threads. To move the carriage and knife toward or from the grinding wheel, a shaft is held in links pivoted to the front part of the table, the shaft having at its outer ends eccentrics engaging vertical slots in offsets on top of the carriage, while from one of the eccentrics extends outward a reduced part of the shaft on which is secured an arm carrying a weight. By swinging the arm upward the knife is drawn from the wheel, and when the arm is swung down to a normal position, regulated by a screw, the carriage slides to

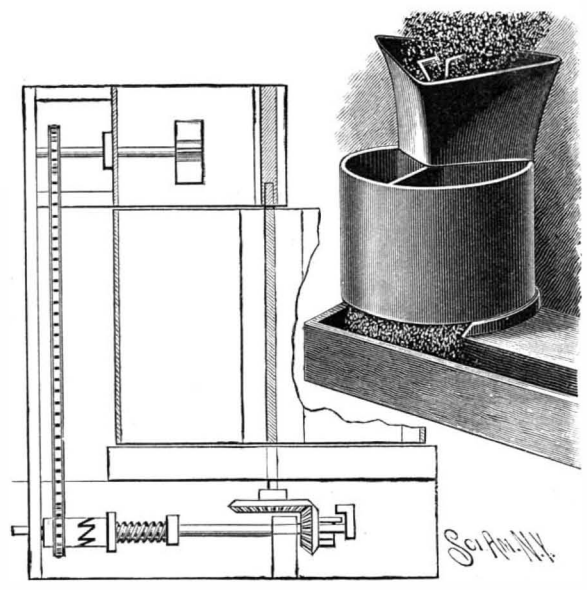


WHEELER'S KNIFE-GRINDING MACHINE.

bring the knife in contact with the wheel. On one of the trunnions of the knife head is a loosely rotating worm-wheel on which is a spring-pressed pin adapted to engage one of a series of apertures in a plate on the trunnion, the worm-wheel being in mesh with a vertical worm, and the outer end of the pin having a suitable knob by means of which it may be manipulated. When the pin is in engagement with the plate and the operator turns the worm, the knife is swung toward or from the grinding wheel to enable the operator to adjust it according to the bevel desired.

AN AUTOMATIC GRAIN MEASURING MACHINE.

The improved grain measurer shown in the illustration is more especially designed for use in connection with thrashing machines, to measure the grain as it leaves the machine. It has been patented by Mr. John W. Kershaw, Jr., of Burnside, Iowa. The cylindrical grain receptacle, open at the top and bottom, is preferably divided into three compartments, and is adapted to be revolved upon a fixed bottom, part of which is cut out to discharge the grain from one compartment at a time. The receptacle is intermittently revolved by a vertical shaft whose upper end has a bearing in the hopper above. The hopper has a cross section corresponding to that of one of the compartments of the measuring receptacle, and within the hopper a rimless wheel is revolved by means of a sprocket chain passing over a sprocket wheel turning loosely on a drive shaft, as shown in the sectional view, the drive shaft being held to rotate continuously in bearings at one side of the receiving trough. One face of the sprocket wheel has clutch teeth adapted to be engaged by clutch teeth on a spring-pressed wheel mounted to turn with and slide on the drive shaft, but the tension of the spring is such that, on the accumulation of grain in the hopper, to impede the rotation of the rimless wheel therein, the clutch teeth will slide by each other, and the motion of the sprocket chain will be stopped. At the same time the sliding movement of the spring-pressed wheel on the drive shaft operates a longitudinally sliding rod engaging a spring-pressed trigger on a gear wheel meshing into a bevel gear wheel on the lower end of the shaft of the grain receptacle, whereby the latter is turned so that its

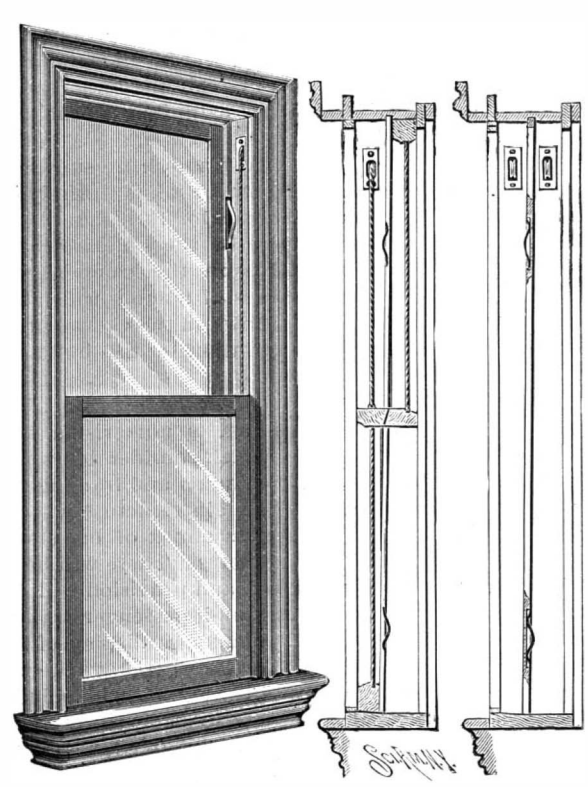


KERSHAW'S ROTATING GRAIN MEASURER.

filled compartment is brought over the cut-out portion of the fixed bottom, the grain flowing through into the receiving trough, while an empty compartment at the same time comes under the hopper. The inflowing grain not only fills each measuring compartment completely, but also occupies some of the space of the hopper, before the movement takes place by which the measured grain is discharged into the receiving trough.

AN IMPROVED WINDOW FRAME.

The accompanying illustration represents, in front elevation and vertical sections, an improved construction of the sash slideways of window frames designed to effectually prevent draughts and the rattling of the sashes, which, when closed, will be firmly wedged in place. It has been patented by Mr. August Schmidt, of No. 1768 Amsterdam Avenue, New York City. The frame is of the ordinary pattern except in the slideways of the upper and the lower sash, of which the parting rail, instead of extending vertically from top to bottom of the frame, is placed diagonally, so that the upper portion of the slideway for the upper sash is narrower than the top portion of the slideway of the lower sash, while at the bottom the slideway of the lower sash is narrower, and that of the upper sash wider. The width of the slideway of each sash at the top and bottom approaches as nearly as possible that of the thickness of the top and bottom rails of the respective sashes. In the wide portion of each slideway a spring is placed in a recess in the parting rail, in such position that when the sashes are closed they will be firmly held to prevent rattling and the wind from entering the room. As the taper of the sash slideways is very gradual, the sashes are designed to be freely moved without binding, so that they can be easily raised and lowered, while the springs enable the sashes to be held in any desired position in the wider portions of the slideways without exerting tension at all times on the sash cords.



SCHMIDT'S WINDOW FRAME.

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THE EXHIBITION OF 1892-93.

The site of the next World's Fair, as it now appears, with the water surfaces, grounds and buildings laid out, and the work thereon in various stages of progress, forms the subject of our first page illustration. The view is taken looking south from the Fine Arts Building, the ground to the north, not shown, and which has heretofore been the most improved portion of Jackson Park, having been allotted to the different States. It is expected that this portion of the grounds will be covered with scores of buildings, presenting an exceedingly picturesque array, in which will be embraced every variety of architectural taste or fancy.

At the beginning of the work on the grounds, all the land south of the "branch," where the lagoon and wooded island have been formed, was a stretch of sand dunes, with stunted oak trees and sweeps of marsh grass. This is where the main buildings of the Fair are now being erected, and for the foundations of which the high ground has been made higher, while the lower levels have been scooped out to form the lagoon, canal, and basin, the landscape gardener's art having been employed contemporaneously with that of the engineer, so that the previous barrenness will be superseded by lawns, terraces, flower beds, etc. When the sites of the various buildings were settled and their limits staked out, then the grade had to be raised to the regulation height previously determined upon before the foundations could be commenced, the dredger being largely employed to furnish the necessary filling.

The main building of the Palace of Fine Arts, the design for which has been but recently accepted, is to be a most imposing structure, occupying a space 320 by 500 feet, and to the rear, on each side, will be an annex, reached by a covered passage, each of these additional buildings covering a ground space of 120 by 200 feet. Fifty brickmasons and a large force of carpenters are at work on the building; the lake bordering on the building site has been pumped out, and on the spot where the boathouse stood last summer the masons have put in the brick and concrete foundations.

The Woman's Building is in the most advanced state of all the structures thus far commenced, and is about ready for its roof. The design for this building was made by Miss Sophia G. Hayden, of Boston, who won a $1,000 prize offered for the best plan. The structure measures 200 by 400 feet, and is to cost $200,000. The architecture is classic, with end and center pavilions, connected by an arcade. The center pavilion contains the main entrance to the building, from which the visitor enters the main gallery, 60 by 240 feet, to the left of which is a room 80 by 200 feet, in which there will be a retrospective exhibit, while a similar space at the other end of the building will be devoted to reforms and charities. Portions of the building are also allotted for a model kindergarten, a model hospital, a library and record room, a bureau of information, club rooms, committee rooms, parlors, etc. The main portion of the building is three stories high.

Beyond the Woman's Building, facing the lagoon on the land side, is the Horticultural Building, 1,000 feet long and with an extreme width of 286 feet. It was designed by W. L. B. Jenney, of Chicago, and in front will be a flower terrace for outside exhibits, including tanks for nympheas and the Victoria regia, while the front of the terrace will have a low parapet between large vases bordering the water, with a boat landing at the center. The building will have a central pavilion and two connected end pavilions, forming two interior courts each 88 by 270 feet, the courts being beautifully decorated in color and planted with ornamental shrubs and flowers. The center pavilion will be roofed by a crystal dome, 187 feet in diameter and 113 feet high, under which will be exhibited tall palms, bamboos, and tree ferns. The exhibits will include all the varieties of flowers, plants, vines, seeds, horticultural implements, etc., those requiring sunshine and light being placed where the roof is entirely of glass, while provision will be made for furnishing heat where required. The exterior of the building, and that of nearly all the buildings on the grounds, will be in staff or stucco, the process of making which in the various forms required is shown in the views at the top of the page. The appropriation for this building is $400,000.

Opposite the southwestern corner of the lagoon, beyond the Horticultural Building, is now rising the Transportation Building, on which considerable work has been done, the irregular columns and framing indicating its great extent. The main structure will be 960 by 256 feet, with a triangular annex of one story buildings covering about nine acres. There will be a railway track every sixteen feet, and provision will be made to exhibit entire freight and passenger trains. It is expected there will be an immense display of locomotives, all placed end on to the central avenue or nave of the main building, and the exhibit will include everything devoted to transportation, from the crudest carriages to a mogul engine. It is intended to make this building very refined and simple architecturally, but rich and elaborate in detail. The main entrance will consist of a great single arch, enriched with carvings, bass reliefs, and mural paintings, treated entirely in leaf, so that it is styled the "golden door."

The structure devoted to mines and mining, immediately south of the lagoon, is pretty well advanced in construction. Its lofty roof will be supported by iron columns, which are now in position, while all around are heaped great piles of sawed material, and groups of men are busy on every part of the structure. The style of architecture is classic, and the dimensions are 350 by 700 feet, the height to the main cornice being 65 feet. There is an entrance on each side of the building, but the grand entrances are at the north and south ends, and are 110 feet high by 32 feet wide each, opening into a vestibule 88 feet high and elaborately decorated. At each corner is a pavilion 68 feet square and 90 feet high, surmounted by a dome. The roof will be of glass. The cost of this building is placed at $350,000.

By the side of this building, and covering the same space, is the site of the building for the electrical exhibit, which is not nearly so far advanced in construction. The structure now presents only a broad stretch of smooth flooring, littered with bits of wood, kegs of nails, trestles, work benches, etc., with a fringe of studding around the margin, and a derrick lifting posts into place. It is intended that this building shall be one of the handsomest in the group south of the lagoon, its cost being placed at $650,000. Its exterior will be finished to represent granite, and a statue of Franklin will be conspicuous before the south entrance.

But the greatest building of all, the Hall of Manufactures and the Liberal Arts, between the lagoon and the lake, has only its floor laid, there being near by a large temporary eating house for the men, while strung along the borders are piles of sawed stuff, with which numerous workmen are engaged, while numberless others with spades and wheelbarrows are busy on the grounds around. This building will be 788 feet wide by 1,688 feet long, having two interior courts. It was designed by George S. Post, of New York, in the French Renaissance style, and will be surrounded on all sides by a porch two stories in height, affording a promenade and view of the other buildings and of the lagoon covered with craft of all descriptions. This building covers more than thirty-one acres and is said to be three times as large as the largest building at the Paris exposition.

To the south of the Mines and Mining and Electricity Buildings may be seen the foundations, in the form of a Greek cross, of the Administration Building, the outer sills at present awaiting the sleepers and connecting beams. This building, one of the most imposing and expensive of all the structures upon the grounds, will be adorned with scores of statuary figures, and will have a gilded dome rising 250 feet above the ground. Richard M. Hunt, of New York, President of the American Institute of Architects, is its designer, and the building will be the headquarters of all the numerous officials connected with the management and administration of the exhibition.

Fronting this building, and on its side farthest from the lake, will be the terminal station of the railway lines, on which no work has yet been done, and still farther to the south comes Machinery Hall, covering a space of 500 by 850 feet, with an annex of 450 by 550 feet, besides a power house. The uprights are mostly in place along the sides of the main building, and the floor is mostly laid, the floor laying in most of the structures appearing to follow first the fixing of the foundation posts. The interior of this building will present the appearance of three railroad train houses side by side, surrounded on all four sides by fifty-foot galleries. In each of the three long naves will be an elevated traveling crane to facilitate placing machinery, etc., and after the exhibition opens platforms will be placed on them from which visitors may view the exhibits without the trouble of walking around. Shafting for power will be carried on the same posts by which the traveling crane bridges are supported, all steam power being supplied from the power annex. The exterior of Machinery Hall toward the stock exhibit and the railroad will be very plain, but on the two other sides it will be rich and imposing.

To the left of Machinery Hall, across a narrow arm of the basin, is the Agricultural Building, occupying a space 500 by 800 feet, and having an annex, 300 by 500 feet. The floor of the building is completed, and a vast quantity of lumber for the superstructure is on the ground. It will be almost entirely surrounded by water, and will be one of the handsomest structures on the exposition grounds. It will have five pavilions, one at each corner and one in the center, and the grand entrance on the north will be sixty feet wide. At the entrance are Corinthian columns 5 feet in diameter and 40 feet high, beyond which is a rotunda 100 feet in diameter, surmounted by a glass dome 130 feet high. The roof will be principally of glass.

Beyond the annex of the Agricultural Building is to be a sawmill, 125 by 300 feet in size, and across another arm of water, toward the lake, is the site of the Forestry Building, the foundations of which are complete and the laying of the floor is in progress. This building will be 200 by 500 feet in extent, and beyond it, farthest south of all the buildings, will be a dairy building, occupying a space of 95 by 200 feet.

On the Government and Fisheries Buildings, near the north end of the lagoon, but little has been done; but the salt water reservoir for the Fisheries Building is under way.

The Government Building will be 350 by 420 feet in size, with a dome of 120 feet in diameter and 150 feet high. It will be constructed of stone, iron, and glass, and cost $400,000. The exhibits shown here will be from the war, treasury, agricultural, interior, post office, and navy departments, the Smithsonian Institution, the national museum, etc.

The Fisheries Building, 700 feet in length, will be flanked at each end by a curved arcade, connecting it with two octagonal pavilions in which will be aquaria and exhibits of fishing tackle. The building will be Spanish in style, and color will be liberally used in its decoration. It was designed by Henry Ives Cobb, of Chicago.

On the lake shore, east of the Government Building, there will be a gun battery, a life-saving station and apparatus, a lighthouse, and an exhibit of war balloons, while the full-sized model of a battle ship will be built on piling near the adjacent pier, the structure being of brick coated with cement, and being made to appear in every way like a real ship, fully manned and equipped.

Comparisons are constantly and almost necessarily made of the prospects for the attainment, by the managers of the Chicago World's Fair, of a success equal to that achieved by the French exposition of 1889. It is already certain that the buildings will cover twice the area and cost twice as much as did those at Paris in 1889, and the grand total of all the appropriations for the Fair promises to be from three to four times the amount expended on the French fair. The actual cost of the latter has been variously stated, but the following figures, only recently published by the London *Economist*, showing the appropriations and receipts (counting five francs to a dollar), may be considered as authoritative: "The receipts were estimated at $8,600,000, including subventions of $1,600,000 from the city and $3,400,000 from the state. But they realized $10,000,000. Only $2,900,000 had been counted upon as receipts from admissions, but these were $4,300,000. The credits opened $9,300,000, with the real outlay under $9,000,000. The surplus was about $2,000,000. The exhibition of 1867 cost $4,688,000, and realized, with subventions, $5,250,000. The exhibition of 1878 cost $11,080,000, including $2,800,000 for the Trocadero Palace, still preserved, and there was a deficit of $6,340,000."

It is estimated that about thirty thousand tons of staff will be used in the finishing of the buildings, this material being employed on nearly all the structures. The upper picture on the first page represents one of the rooms of the Staff Decorative Co., who are now employing about two hundred men making this material, which is fireproof and is furnished in shapes and forms suitable to be nailed to the frames of the buildings, inside and out. Fig. 1 represents the raising of the gelatine mould from the cast, and Fig. 2 shows the fluting of the large columns for the Electrical Building. Gelatine is now more largely used than any other material for the moulds, although when there is no undercut, plaster, wax or sulphur moulds may be employed, or wood or metal forms. The staff itself is a composition of plaster of Paris and fiber, with some other materials, as alumina, glycerine, dextrine, etc., according to the special casting which is to be made or the kind of mould employed. To prevent brittleness, the material is cast around coarse cloth bagging or oakum. This material was first used in the Paris Exposition buildings of 1878. Its natural color is a murky white, but other colors may be produced by external washes, while the castings may be made to accurately represent cut stone, rock-faced stone, mouldings, and the most delicate designs of every kind. For the lower portion of the walls the material is mixed with cement to make it hard.

For courtesies extended our thanks are due Messrs. A. L. R. Van den Berghen, of the Staff Decorative Co., and Dion Geraldine, Chief Superintendent Construction Department of the Exposition.

Soapstone.

Soapstone, or steatite, can be made into anything. Very beautiful stoves are made of it, and stationary washtubs and sinks are important products. Not an ounce need be wasted, for the dust is used to adulterate rubber goods, giving so-called gum rubbers their dull finish, and in paper, too, it is used to give weight, while all waste can be ground up into a flour which can be made into a fireproof paint for the interior of mills or the roofs of buildings.

A GERMAN chemist has succeeded in producing artificial silk, which has all the qualities of the natural article except strength, wherein it is deficient, being only two-thirds as strong.

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Correspondence.

Hedge Trimmer Wanted.

To the Editor of the Scientific American:

A machine is much needed for trimming hedges.

It should be mounted on a wagon, midway between front and hind wheels.

The cutting part should be capable of guidance independent of the wagon, to an extent of one or two feet, up, down, and sideways. The cutter must run by power independent of the team that pulls the wagon.

The cutter may be a sickle or a set of whirling disks, very strong.

The power may be a gas or steam engine, on the wagon, or an electric motor, or anything that will not bother or *burst* (a tread power might do, but a horse would be heavy to haul around).

The whole business should be cheap, strong and convenient. Such a combination is not impossible these days.

A common farm wagon slightly modified would do. The power could do other work when the hedges were all trimmed.

Can't some of your mechanical readers build such a machine? Not much invention required on it.

J. A. C.

Dangers of Galvanized Iron Water Pails.

To the Editor of the Scientific American:

In Notes and Queries (No. 3545) W. S. inquires about galvanized vessels for water. For the benefit and perhaps the safety of others, I will relate my experience with them. Some few years ago I purchased a new galvanized water bucket and filled it with water to be used for drinking and cooking. I was living alone at the time, so was not using very much water; consequently there was some water in the bucket a few days after it was put in, but it had been used down quite low. One morning I got up early and got my breakfast by lamp light, not thinking to look at the water I was using to mix my batter for griddle cakes and steep my tea. Well, I ate my breakfast with a relish, having a good appetite, but I did not have it down long before it had a strong desire to come up, and up it began to come. I commenced throwing the contents of my stomach up in a way that for power or speed would put to shame any "jet propulsion" ever tried yet. I vomited violently in succession, at short intervals between, about a dozen times, which cleaned my stomach out quite completely. I knew that something I had eaten or drank was the matter. I looked in the water bucket, and behold! the water in there was nearly as white as milk and quite thick. I knew then that I had taken an overdose of zinc poison, and I think that I was lucky that it was such a quantity; for if I had not taken enough to vomit me, it would have, most likely, produced my demise.

I have lately bought another new galvanized bucket and have tested it to see what and how much comes off by the action of water. I filled the bucket with water and let it remain one week, stirring round the inside occasionally with a stick; then I turned off the clear water from the top and found at the bottom, in thick solution, *four fluid ounces* of carbonate of zinc, dissolved by the water, which, in this section, contains much carbonic acid. But for all this, I think that if such vessels were thoroughly soaked say two or three weeks, scraping the inside occasionally, and thoroughly washed afterward, and the water not allowed to stand long in them, there would not be much danger in using them; but what effect it would have on the general health of the users I am unable to say.

A. JOSSELYN.

Crescent City, Florida, November 5, 1891.

[It is evident that wooden pails would be safer to use for your water.—ED. S. A.]

How to Make a Storage Battery.

To the Editor of the Scientific American:

I have read with interest the communication from Dr. J. E. Stanton, of Boston, Mass., in a recent issue of the SCIENTIFIC AMERICAN on the subject of storage cells charged by primary battery. As you request further correspondence on the subject, I will give you my own results.

A short time ago I arranged a "plant" for a physician of this city, Mr. Wm. E. Moseley, consisting of two storage cells connected in series and charged with six 5×8 gravity cells. Each of the storage cells contains six lead plates coated with red lead composition and connected alternately in the usual manner, the total active surface of the plates in the two cells being about 580 square inches. The storage cells are used for operating, through a suitable resistance, a small incandescent lamp, rated at two candles, but giving rather more light when worked to its full capacity; and also for heating the platinum loops of a galvanocautery. It operates perfectly, giving daily, during office hours, all the current required for the lamp and platinum loops, which are used at intervals.

A switch is provided by means of which the circuit of the charging cells may be opened when required, that they may not do useless work in forcing current *through* the storage cells after the cells are thoroughly charged.

The gravity cells require little attention save in the matter of adding water lost by evaporation, drawing out at wide intervals a portion of the solution of zinc sulphate at the top of the cells, and dropping in crystals of sulphate of copper from time to time.

This battery, connected experimentally with a sewing machine motor, drove it continuously for two hours; by adding more plates to the storage cells, a greater number of working hours could easily be obtained if required. It is usually advisable to purchase the storage cells, but they can be constructed, and if their manufacture is attempted, the following wrinkle may be of service: Cast the plates rather thick, that they may not bend too easily; roughen them thoroughly and deeply, on both sides of the plates, with a piece of coarse file, or special rough-faced punch, driven into the lead. Punch out half-inch holes through the plates at regular intervals, and cut or trim the holes so that they bevel on each face of the plate. Now coat the plates carefully with a stiff paste of red lead mixed with water two parts, sulphuric acid one part, taking care to fill the holes completely. Allow to dry twenty-four hours, and then wrap the portion of each plate to be immersed in the acid solution with a layer or two of white cotton cloth, bound firmly to the plates with thread. Arrange plates in the cells in the usual manner, separated and held in position by insulating strips; fill up cell with the mixture of sulphuric acid and water; connect the charging battery, and *charge well* in one direction; discharge through a resistance, and recharge in same direction as before. Keep cells well charged, and at the end of a week carefully remove the cloth coverings, and the paste will be found to *adhere* strongly to the plates and fill the holes completely. When the cloths are not used, nearly all the paste *falls off* as soon as the plates are immersed in the fluid previous to charging. Rating each storage cell at two volts, a sufficient number of charging cells must always be used in series to give a voltage *at least* 10 per cent in excess of the sum of the voltage of the storage cells in series. Bichromate cells are best for *forming* the paste when the cells are new; afterward the gravity cells answer every purpose.

C. L. WOOLLEY.

413 Robert St., Baltimore, November 14, 1891.

Leprosy: Its Spread and Causation.

To the Editor of the Scientific American:

My attention has been called to an article in the SCIENTIFIC AMERICAN on the subject of "leprosy," and having devoted some attention to the causation and increase of this dreadful and incurable malady in our various colonies and dependencies, as well as in the Pacific islands, I shall be glad, with your permission, to offer to your readers, in the interest of the public and public safety, a brief statement of my conclusions. The belief that leprosy is contagious seems to have taken possession of a certain section of the public mind, and this fact, it is alleged, is clearly demonstrated by the case of Father Damien. While not disposed to contest the possibility of this theory, I will state that it is not in accordance with two inquiries of the Royal College of Physicians or of my recent observation and investigations. A medical resident of sixteen years' standing in British Guiana told me that the disease was being extensively disseminated in some unexplained way, as the infected population had greatly augmented of late years; you encountered them in churches, at balls and public meetings, in the streets and the market place. Several leprous patients were pointed out to me at the Colonial Hospital, Georgetown, in close proximity to the other inmates, and I may observe that only the worst cases (and these belonging to poor families) are segregated at the leper hospitals. The lazarettos at Gorchum and Mahaica, British Guiana, at Trinidad and Barbadoes, were full to overflowing; new wings were in progress, or had recently been added, and the demand considerably exceeded the present accommodation in every instance. No one, however, appeared to be afraid of contagion, and I could not learn of a single case so communicated. After going through the various buildings of the leper asylum at Mucurapo, Trinidad, and seeing the unfortunate patients in every form of this hideous and mutilative disease, I said to the lady superintendent (of Dominican Sisters), who had been in charge of the institution for seventeen years, "Have you no fear of contagion?" "Not the slightest," she promptly replied. "And you and your assistants do all that conscientious nursing requires?" "Certainly, and feel it a joy and privilege to be of service to these afflicted people." "Has any case of infection by contact to doctor, nurse, attendant, or laundress ever been reported during your superintendence?" "Not one." This experience was confirmed at the lazaretto in Barbadoes, Colombo, Kalili, Honolulu, and elsewhere, and some of the nurses and attendants have been employed from ten to thirty years. The result of my inquiries may be briefly summarized as follows:

1. That evidence from all authorities shows that leprosy is seriously increasing in India, the Mauritius, Hawaii, the West Indies, Russia, and South America.

2. The theory of contagion put forward to account for this increase is doubtful, and is denied by the highest medical authorities, both at home and abroad, and, if true, would only account for an infinitesimal portion of such increase.

3. All authorities, including the *Lancet* and the *British Medical Journal*, admit that leprosy may be communicated by inoculation.

4. That the only method of inoculation extensively and increasingly practiced is by means of arm-to-arm vaccination, and that leprosy has been distinctly traced to this source by medical practitioners in the West Indies, British Guiana, in Norway, and in the Sandwich Islands; by medical superintendents of the leper asylums; by distinguished authorities, as Dr. Tilbury Fox, Sir Erasmus Wilson, Dr. Gavin Milroy, Professor W. T. Gairdner, of Glasgow, Dr. John D. Hillis, Dr. Edward Arning, Hamburg, Dr. Bourne Swift, Professor Montgomery, Dr. A. M. Brown, Dr. Blanc, Professor of Dermatology, University of New Orleans, Dr. Hall Bakewell, Dr. Bechtinger, and others. Proofs of the spread of leprosy by vaccination in various countries have already been laid before the Royal Vaccination Commission now taking evidence in London. These proofs will be found in the third report of the proceedings.

WILLIAM TEBB.

Devonshire Club, St. James', London, Nov. 6, 1891.

The Electric Headlight.

The use of electric headlights has now become quite general in Indiana, nearly all the roads entering Indianapolis now having several in service.

A representative of the *Railroad Gazette* made a trip over the Indianapolis, Decatur & Western from Indianapolis to Decatur lately on an engine equipped with the light. Its power is approximately 2,500 candle power, and it gives the engineman a light which on a straight track will often reveal objects at a mile or more, and for fully one-half a mile all objects of the size of a cow can be distinctly seen in ordinary weather. The greatest distance at which an object was seen was 2½ miles. This was a window of a station house in which no lamps were burning. When the light was first reflected from the window, the appearance was that of a locomotive headlight about a mile away. The window seemed to increase in size until at a distance of about three-quarters of a mile the effect was that of a burning structure. At this distance the outlines of the building could be distinctly seen. These distances were easily computed by counting the telegraph poles, which are 200 feet apart on this road. A water tank was sighted at nearly a mile, appearing much larger than it really was. Bridges with overhead trusses could be seen at half a mile. The highway crossing fences along the line had been freshly whitewashed and with little effort could be seen a mile.

Collisions have been prevented by the use of these lights.

The expense of running the light is nominal. The demand for steam from the locomotive is small, and the carbons, which last eighteen hours, cost but 70 cents per 100.

Fathers of Electrical Science.

At a meeting of the Committee on Electricity, Electrical and Pneumatic Appliances, of the World's Columbian Exposition, the following names were decided upon as those of eminent electricians not now living, to be placed over the Electricity Building at the Exposition, namely:

Franklin,	Page,	Joule,
Galvani,	Weber,	Saussure,
Ampere,	Gilbert,	Cooke,
Faraday,	Davenport,	Varley,
Ohm,	Soemmering,	Steinheil,
Sturgeon,	Don Silva,	Guericke,
Morse,	Arago,	La Place,
Siemens.	Daniell,	Channing,
Davy,	Jacobi,	Priestley,
Volta,	Wheatstone,	Maxwell,
Henry,	Gauss,	Coxe,
Oersted,	Vail,	Thales,
Coulomb,	Bain,	Cavendish.
Ronald,	De la Rive,	

The Hydraulic Stone Crusher.

In a recent article descriptive of the stone-breaking industry, as carried on in Weehawken, N. J., allusion was made to the breaking machine as being of the Blake pattern. This was an error, as the device employed is the Smith hydraulic crusher. This remarkable machine, which, by the way, is on exhibition at the American Institute Fair, this city, has been greatly improved, and is now probably one of the most safe and powerful instruments for the purpose ever produced. In connection with the hydraulic cylinder it carries a relief or safety valve, which is set to open at four tons to the square inch, this enormous pressure being available for crunching the blocks of stone. The relief valve protects the machine from breakage, the result being that the mechanism endures for years, even when run at its full capacity. The Case & Redfield Machinery Co., 16 Court St., Brooklyn, N. Y., makers.

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STATIC ELECTRICAL MOTORS.

In our issue of August 1, of this year, we published a brief account of a static electro-motor devised by Mr. James Wimshurst, of England. Mr. Wimshurst is the author of the static or influence machine which bears his name, and his motor is but a modification of the machine. To quote from the account to which we refer: "It consists of a glass disk, mounted on a vertical spindle, and carrying on one face a number of tinfoil sectors. The upper face of the disk is touched at two places by brushes connected by wires to the poles of the influence machine, while at right angles to the diameter joining these brushes there are two other brushes connected by an equalizing rod. Below the rotating disk is a stationary one, having upon it two sectors of tinfoil extending about 90°. These sectors are also in communication with the poles of the influence machine. As soon as the latter is put in motion, the glass disk begins to rotate and rapidly attains a very considerable speed, turning with an amount of force which is quite remarkable." Those of our readers who are familiar with the well known pith ball experiments, and who also have a knowledge of the construction of the Wimshurst machine, will have no difficulty in forming a mental picture of the motor in operation.

Taking the above somewhat meager description of Mr. Wimshurst's production, Mr. William McVay, of 19 East Sixteenth St., New York, has constructed a motor which is very gratifying and instructive in its operation. We illustrate it in Fig. 1. Mr. McVay employs two glass disks, each 12 inches diameter. The upper one, which rotates, bears upon its upper surface sixteen tinfoil sectors, 3 inches in length, and in width from a quarter of an inch at the *inner* ends to five-eighths of an inch at the *outer* ends. The lower disk, which is stationary, carrying the 90° sectors, is supported four inches above the base by a piece of hard rubber tubing. The spindle to which the upper disk is attached is also of hard rubber. The metallic conductors, supported at either side of the disks by the standard of the frame, have each two arms, bearing at their extremities small brushes made of tinsel. One arm of each conductor passes under the lower disk, and presses its brush against one of the 90° sectors of the stationary lower disk, and the other arm is extended over the upper disk and presses its brush lightly against the sectors of the rotating disk as they pass. When the sectors of the rotating disk are brought into contact with a brush carrying a charge of electricity of one sign, they become similarly charged, and are, consequently, attracted by the sector on the lower disk, which is constantly charged with electricity of opposite sign. The equalizing rod, the position of which may be seen in the illustration, serves to discharge the sectors and put them in a neutral condition preparatory to their being recharged.

The motor may be made to turn with equal velocity in an opposite direction by connecting both sets of charging brushes with one pole of the machine and attaching the conductor from the opposite pole to the equalizing rod or by "grounding" the rod. In fact, it is a very accommodating motor, willing to do anything within its power to oblige. It occurred to Mr. McVay that there was no good reason for an adherence to the form of motor adopted by Mr. Wimshurst, and as a result he has produced four motors of his own design, all of which we illustrate. They furnish an excellent example of the evolution of an idea. In Fig. 2, Mr. McVay employs two glass shades as substitutes for the glass disks. The smaller shade is supported by a glass tube and is stationary, while the larger one is placed over it and turns on a point fixed to the top of the inner shade. Our artist has done his work so well that further explanation of the construction is not deemed necessary. A more elegant design is shown in Fig. 3. This motor stands about nineteen inches in height and has the appearance of being constructed entirely of hard rubber and brass. A glass shade is also used in this case, but instead of utilizing another shade as a carrier of the 90° sectors, as in Fig. 2, an inverted battery jar serves the purpose and at the same time furnishes a support for a glass spindle upon which the cylinder turns; thin brass brushes are substituted for the tinsel used in making contacts in the previous motors. When one sees this motor in operation, running as it does at a high rate of speed, it seems incredible that the motive power is static electricity.

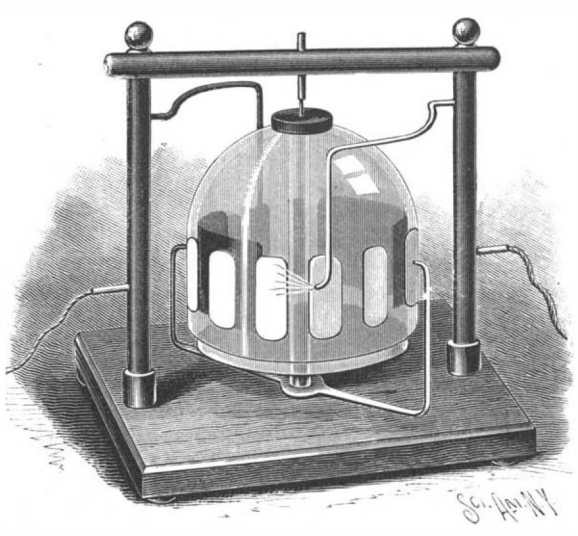

Fig. 2.

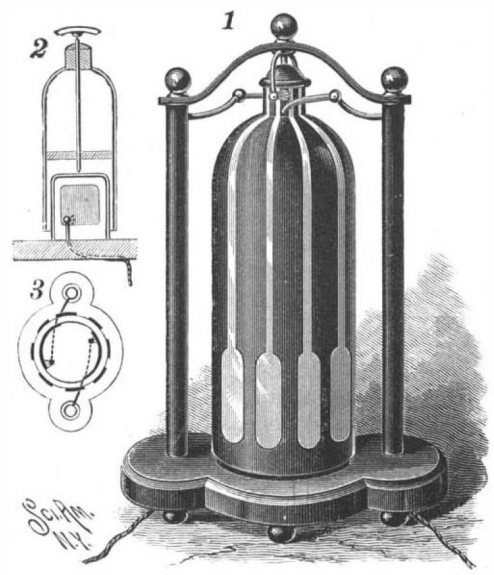

Fig 3.

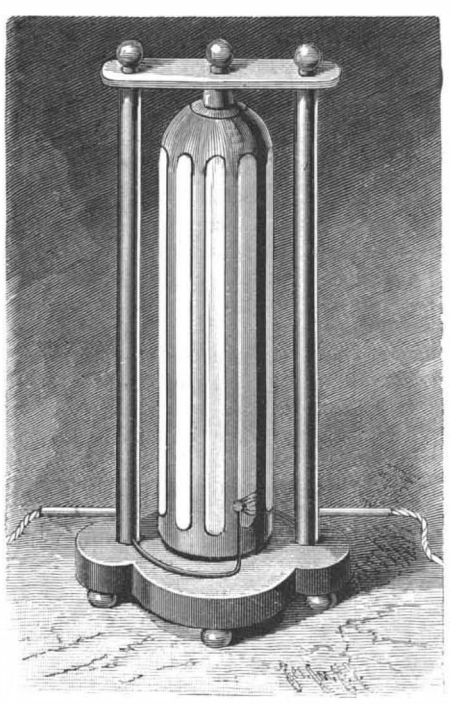

Fig. 4.

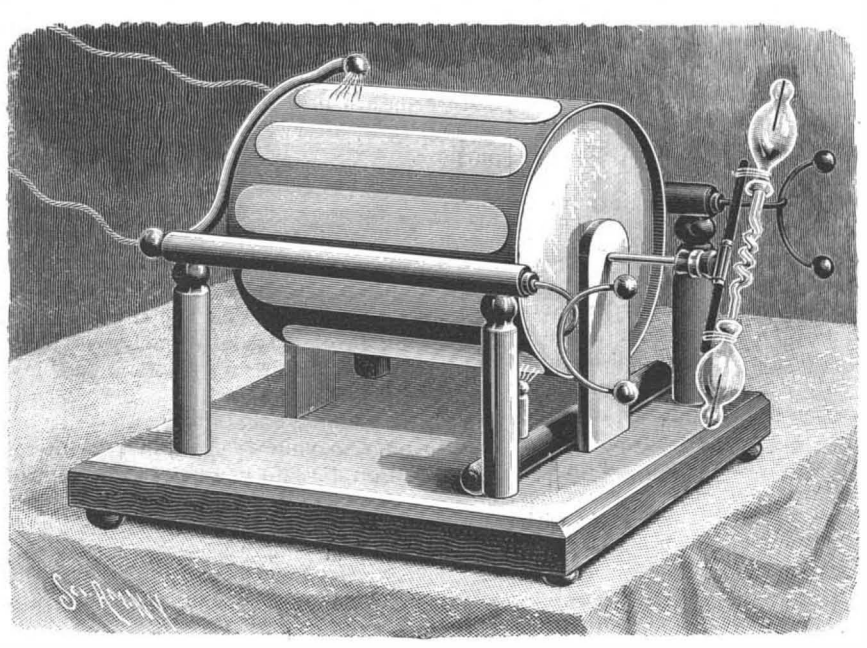

Fig. 5.

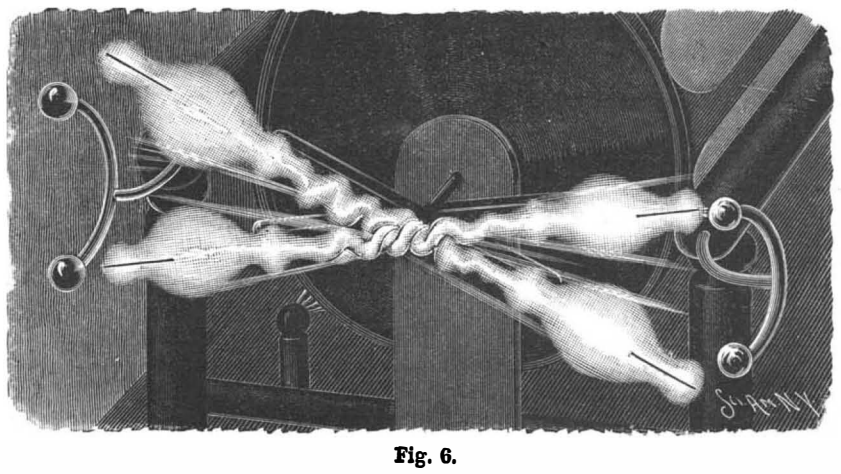

Fig. 6.

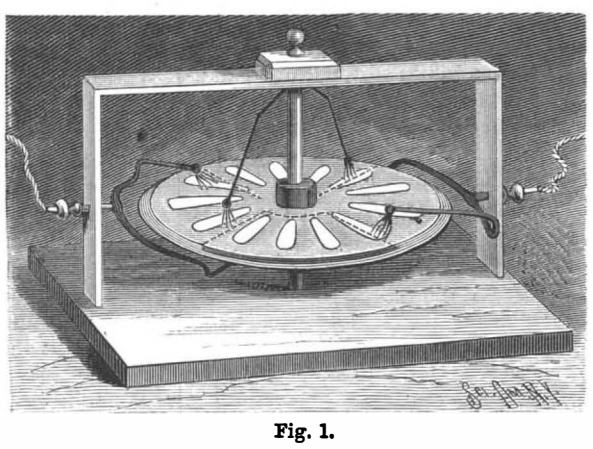

Fig. 1.

STATIC ELECTRIC MOTORS—CONSTRUCTED BY WILLIAM McVAY.

Fig. 4 is so simple in its construction that the principle upon which it works can be understood at a glance. In the construction of this device a glass shade is also employed. It carries upon its surface eleven strips of thin sheet brass about six inches in length and half an inch in width.

In this case the pillars at either side serve the same purpose as the 90° sectors in Figs. 1 to 3, as they are constantly charged with electricity of opposite sign, and consequently there is a strong attraction between them and the sectors carried by the cylinder when they become charged in turn by coming in contact with the brushes, which are so situated that they come in contact with the sectors when the latter are about an inch away from the pillars, which, by the way, are also of brass. The speed attained by Fig. 4 is remarkable, and when it becomes thoroughly charged it shows such a decided inclination to leave its base that it has to be held down. In Fig. 5 we have the static electromotor in its most efficient form. It does actual work, and is here shown rotating a Geissler tube, which is lighted by the same machine that furnished the power for the motor. The optical effect of the rotation of the tube is shown in Fig. 6. This motor is constructed entirely of brass, rubber, and wood, and consequently is less fragile in appearance, and is suggestive of real power.

The cylinder of this motor is of hard rubber, and is six inches in length and about four and a half inches in diameter, with brass sectors ¾ of an inch in width running along the full length of the cylinder. The cylinder has a $\frac{3}{16}$ inch iron rod passing through it. The rod has steel ends where it comes in contact with the brass bearings. The supports for the cylinder are of hard rubber, as are also the supports for the pole pieces, which will be seen at either side of the cylinder. The dielectric used as a covering for the pole pieces is sheet rubber. The points at which the sectors receive their charges may be seen at the right hand side of the cylinder, at the rear, and at the left hand side of the front end. The position of the Geissler tube is well shown in the accompanying illustration. The projections from the ends of the pole pieces are for the purpose of lighting the tube, which presents a very weird appearance in a darkened room. The subject of the motive power of static electricity is one filled with interest for the student and well worthy of attention.

Mr. McVay has in mind a modified form of Fig. 5, from which he hopes to obtain greater efficiency and a decided improvement in appearance.

THE *Engineer*, London, in an article on high speeds on railways, speaks of the dangers which attend the working of the present style of locomotives, when running above 60 miles an hour. The centrifugal stresses in the reciprocating parts and counterpoises are enormous, and increase with the square of the speed. The *Engineer* thinks some form of rotary steam engine yet to be invented may prove best for high speeds. Here is a nut for inventors to crack.

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Merchant Navies of the World.

The estimate of the Bureau Veritas with regard to the merchant navies of the world for the present year puts the total number of vessels at 43,514, of which 33,876 are sailing vessels of 10,540,051 tons, and 9,638 steamers of 12,825,709 tons gross and 8,286,747 tons net. The figures as regards the steamers stand as follows:

Nationality.	Number of Ships.	Gross Tonnage.	Net Tonnage.
English	5,312	8,043,872	5,106,581
German	689	930,754	656,182
French	471	805,983	484,990
American	419	533,333	375,950
Spanish	350	423,627	273,819
Italian	200	294,705	185,796
Norwegian	371	245,052	176,419
Dutch	164	220,014	149,355
Russian	230	177,753	115,742
Swedish	403	172,013	126,612
Danish	197	154,497	103,578
Austrian	111	149,447	96,503
Japanese	147	123,279	76,412
Belgian	55	98,056	71,658
Brazilian	129	75,970	48,901
Greek	68	70,435	44,424
Portuguese	41	49,364	29,564

BESSEMER'S FLUID METAL ROLLING MILL.

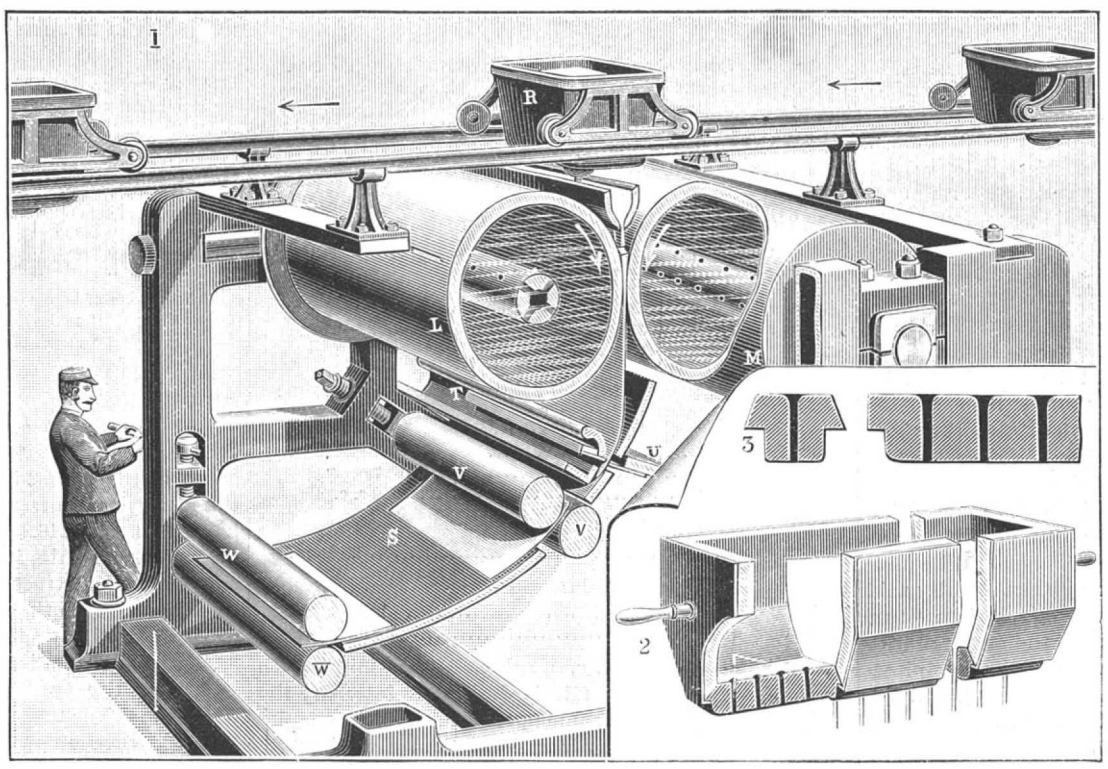
In a paper by Sir Henry Bessemer, recently read before the British Iron and Steel Institute, is described a rolling mill for producing sheets and plates of malleable iron and steel direct from the fluid metal. This mill, shown in the accompanying illustration, is an improved form of one patented by him in 1857, and allowed to rest without development on account of the difficulties attending the perfecting of the steel-making process.

The rolls consist of two hollow drums, L and M, to each of which a tubular steel axis conveys water for keeping the rolls cool. The brasses supporting one of the rolls are fixed, while those of the other are movable and are pressed upon by a hydraulic ram in communication with an accumulator, whereby, should the feed of metal be excessive, one of the rolls will yield to prevent undue strain, and the only fault will be a slightly increased thickness at that part of the sheet, to be removed by subsequent rolling. The rolls are preferably three to four feet in diameter, and each has a flange at one end only, thus forming, when they are in position, a trough with closed ends to receive the fluid metal. For the regular and quiet supply of the metal, a small iron box or reservoir is employed, having a bar or handle at each end, by which it is supported on the side frames. This reservoir, the construction of which is shown in Figs. 2 and 3, is lined along its bottom with plumbago or fire clay, some ten or twenty holes about a quarter of an inch in diameter each being here neatly moulded by a row of conical brass pegs. The reservoir should be well dried, and its interior surface heated to redness prior to use, and in this state it is placed in position only when the first ladleful of metal is ready to be supplied. The ladle, R, is conveyed to the reservoir on rails, and has one or more valves or stoppers for regulating the flow.

An almost constant quantity of metal is thus delivered to the rolls, without splashing, through the several apertures of the reservoir, and these streams do not fall directly on the rolls, but into a small pool formed between thin films solidifying against the cold surface of the rolls, the metal at all times being free from floating slag. The speed of the rolls also affords a means of regulating the quantity of metal retained between them.

The sheet of metal as it emerges from the rolls is received between curved guide plates, S and T, to one of which a cutting blade, U, is bolted, the piece so cut passing between a second pair of rolls, V V, and thence to a third pair, W W, from which it is delivered on a table, or may be allowed to slide into a cistern of water. The construction allows for the cooling and stacking of the plates without labor or trouble.

The thickness of the plates it will be possible to make in this manner will depend largely on the size of the rolls, it being estimated that rolls of ten or twelve feet diameter will be capable of producing plates of about three-quarters of an inch in thickness. In the production of the thin sheets, as described, their exposure to the oxidizing influence of the atmosphere, prior to their immersion in the water, is for so brief a period that they will not acquire any scale, and in consequence of there being no overlapping of plates in rolling, there will be but little loss of metal in shearing.



ROLLING PLATES DIRECT FROM FLUID IRON AND STEEL.

The Boot and Shoe Industry.

Special Examiner Hyer, of the Patent Office, has just returned from a tour of inspection through the great boot and shoe factories of Lynn and Haverhill, in Massachusetts, which may be said to turn out footgear for pretty nearly the entire people of the United States. He was much impressed with the gigantic scale on which the manufacture is carried on at these establishments, some of which have a capacity of from eight thousand to ten thousand pairs a day. A large percentage of the goods thus produced are sold to retailers at from eighty-five cents to $1.50 a pair, although the "stock" used costs from eighty cents to $1.10. Inasmuch as the labor averages thirteen cents on each pair, there is necessarily an actual loss on the cheapest grades, which are merely intended to serve as "leaders." It is an interesting fact that sixty per cent of all the shoes and boots worn in this country are retailed for less than $2 a pair.

"Machinery," said Mr. Hyer recently to a Washington *Star* reporter, "has nowhere been put to more effective use for the saving of labor than in the manufacture of shoes. It is a wonderful thing to see a pair of boots turned out within a few minutes from the raw material, finished and all ready to wear. At the time of the Centennial Exposition in Philadelphia there was a contrivance exhibited which was called by its inventor the 'iron shoe maker.' It made shoes and turned them out complete, but they were clumsy affairs, and the process was a slow one. It has been found best to employ for the purpose a number of different machines, which together perform the operations necessary.

"With the aid of one ingenious device one man can sew together soles and uppers for four hundred and fifty pairs a day. On what is known as the 'standard nailer' a single operator can nail three hundred pairs, the machine making its own nails by wire, pointing them, driving them and at the same time automatically regulating the length of each nail to the thickness of the sole. With loose nails or pegs one person can do six hundred pairs a day, though the toes and heels must be made additionally secure afterward. One pegging machine will peg two pairs of women's shoes per minute, cutting its own pegs from strips of white birch at the same time. A thousand cords of wood are cut into shoe pegs every year in the United States. The wooden peg was invented in 1818, by a Massachusetts man named Joseph Walker.

"The Yankees have always been years ahead of Europeans in the art of making shoes, although the French excel to this day in the finest work for women's footwear. All machines for sewing shoes are of American invention. The last census showed that the manufacture of boots and shoes was the greatest single industry in America, employing the largest amount of capital and the greatest number of individuals. The employes of the trade are about equally divided as to sex. Men do the heavier part of the work, while women sew uppers, bind and fasten on the buttons. Each New England factory—most of them are owned by Boston men—has its specialty. One makes ladies' shoes exclusively, another slippers, another men's boots, another children's footgear, and so on.

"The oldest form of shoe was the simple sandal, which was nothing but a sole. Egyptian priests wore sandals of palm leaves and papyrus, while those of the common people were made of leather. The shoes of Roman soldiers were studded with nails. Heliogabalus had his shoes covered with white linen, and Caligula ornamented his with precious stones. Sandals were worn by both sexes among the Romans in the house, as we wear slippers. At one time the parliament of Great Britain regulated by law not only the quality of the leather, but the number of stitches to be taken in every shoe. Top boots were introduced in the sixteenth century. In China the cobbler goes from house to house and announces his coming with a rattle. In all history, as shown in pictures and bass reliefs, the shoemaker seems to have assumed the same attitude as now in doing his work. It is a very unhealthy one, and few of the craft live to old age. A hollow at the base of the breastbone is often produced by the continual pressure of the last."—*Washington Star.*

Ancient Egypt.

Mr. Flinders Petrie recently delivered at the Owens College, Manchester, a most interesting address on exploration in Egypt. It had been thought, he said, that the immense mounds of rubbish indicating the sites of towns had been made on purpose, but they resulted from the natural decay of the mud brick buildings. These heaps of ruined walls and earth and potsherds rose even to eighty feet high in some places; but other ancient sites were much less imposing, and might even not attract notice on the open desert. The higher the mound the longer the place had been inhabited; and if the surface was of a late period, the earlier parts, which were most needed, were under such a depth of rubbish as to be practically inaccessible. Much could be known at first sight; and prospecting had now become as scientific a matter in antiquities as in geology. Knowing, by a glance at the sherds on the top, what was the latest period of occupation of the site, and knowing the usual rate of accumulation of a mud brick town—about five feet in a century—we could guess how far back the bottom of the mound must be dated. Other remains had different indications. If the midst of a great mound there was a wide flat crater, that was probably the temple site, surrounded by houses which had accumulated high on all sides of it. Speaking of the results of exploration, Mr. Petrie said that we now realized what the course of the arts had been in Egypt. In the earliest days yet known to us—about 4000 B. C.—we found great skill in executing accurate and massive stone work, such skill as had hardly ever been exceeded. We found elaborate tools used, jeweled saws and tubular drills. We saw the pictorial arts as fully developed as they were for thousands of years later. But what led up to this we were still feeling for.

Influence of Surroundings in Producing Insanity.

In the last number of the *Journal of Medical Science* Dr. Savage discusses this question, and begins by protesting against the acceptance of what is a too widely spread notion, viz., that nearly all insanity is the outcome of direct neurotic inheritance. The influence of heredity is not denied or minimized, but the great importance of environment is insisted upon. To quote the words of the author: "We are what we are in mind and body, to a great extent, as organic results of our forefathers; but that we are no longer naked savages is some evidence that progress and development in the individual and the race may take place as the result of changing surroundings." There can be no two opinions as to the encouragement to be got from such a view. A too great insistence upon heredity as the determining cause of insanity must land us in a hopeless pessimism as regards treatment; whereas a recognition of the influence of surroundings is the first step toward the construction of a reasonable and efficacious system of therapeutics. The author also cites many examples of hallucinations and delusions which are suggested by surroundings; and while all will not be inclined to accept his dictum that disorder of function may lead to disease of tissue, there will be few who will not share his opinion as to the efficacy of restful, pleasant surroundings in the treatment of mental disorder, as compared with the virtues of "medicine out of a bottle."

BELTS running over pulleys of small diameter at high speeds ought to be as thin and as wide as possible Orange tan leather of uniform thickness answers remarkably well.

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PHOTOGRAPHIC NOTES.

To Transfer Ordinary Albumen Prints to Wood, Metal, Glass, or Porcelain, it is, according to *Photographie*, sufficient to thoroughly clean the surface to which the image is to be transferred, if it is a polished or a glossy one, and to smooth it if it is a rough one. It is then coated with a thin layer of copal varnish, and the toned and fixed albumen print is placed upon it while still wet. All the air bubbles and the excessive varnish should be pressed out by means of a squeegee or an India-rubber roller, and then the whole allowed to dry for about four hours. After this time the back of the print is moistened by means of a sponge, when it may be lifted off its support, while the albumen film, together with the picture, remains on it. The image is then coated once more with copal varnish in order to protect it and to render it more brilliant. A reversed transfer is obtained in this way. If, however, gelatine negatives which can be stripped from their glass support, or transparent films, are used, a reversed print may be made on albumen paper, and this one transferred in the manner described above.

Orthochromatic Collodio-Bromide Emulsion.—At the suggestion of Professor Eder, Dr. A. Jonas has worked out a method for making orthochromatic collodio-bromide emulsion similar to that introduced some years ago by Dr. E. Albert. The results of this important work have been published by Dr. Jonas *in extenso* in No. 370 of the *Photo. Correspondenz.* The following two solutions are prepared:

Solution No. I.

Bromide of ammonium	64 grammes.
Distilled water	80 c. c.
Alcohol (absolute)	800 "
Thick 4 per cent collodion	1,500 "
Acetic acid	65 grammes.

Solution No. II.

Nitrate of silver (crystal)	80 grammes.
Distilled water	50 c. c.

The silver nitrate is dissolved by heat, and an aqueous concentrated solution of ammonia (specific gravity 0·91) is carefully added in small portions, until the brown precipitate first formed is again just dissolved. About 75 c. c. of ammonia will be required for this purpose. Finally, 800 c. c. of warm alcohol (113° F.) are added. Both solutions may be prepared by daylight. In the dark room, which should be illuminated by orange light, solution No. II. is poured into solution No. I. in a thin stream, shaking violently all the time. The temperature of solution No. II. should be kept at from 104° to 122° F., because otherwise ammonio-nitrate of silver will crystallize out. A drop of the emulsion thus prepared is then brought into contact with litmus paper, and if it be alkaline, acetic acid should be added drop by drop until the emulsion gives a slightly acid reaction. It is then shaken for a quarter of an hour, allowed to stand for an hour, and then poured into five or six times the quantity of water. The precipitated emulsion is collected on a clean linen cloth, and the latter hung in running water for one or two hours. Finally, the superfluous water is gently pressed out, the emulsion washed several times with distilled water, pressed out once more, and spread out on thick blotting paper to dry. For use, dissolve:

Dry collodio-bromide	6 grammes.
Alcohol	40 c. c.
Ether	60 "

To render the emulsion color-sensitive, a certain quantity of picrate of ammonia and glycerine and the solution of the dye is added to it. In the case of cyanin, the following mixture should be prepared:

Collodio-bromide emulsion	100 c. c.
Solution of cyanin, 1 : 150	10 "
Glycerine	1 "

The action of excess of silver nitrate in the dyed emulsion is very remarkable also in the collodion process. If 51 milligrammes of silver nitrate are added to each 100 c.c. of the emulsion, the sensitiveness of it will be increased at least two times. To obtain a highly color-sensitive emulsion dyed with eoside of silver, proceed as follows: A raw emulsion is at first prepared by dissolving 6 c.c. of collodio-bromide in 40 c.c. of absolute alcohol and 66 c.c. of ether by frequent agitation. Then the following three solutions are prepared:

Solution No. I.

Crystallized eosin	4 grammes.
Distilled water	50 c. c.
Alcohol (96 per cent)	450 "

Solution No. II.

Silver nitrate	3·4 grammes.
Distilled water	50 c. c.
Alcohol (96 per cent)	150 "
Ammonia, concentrated solution, until the first formed precipitate is again dissolved.	

Solution No. III.

Picric acid	3 grammes.
Distilled water	10 c. c.
Ammonia to neutralize the solution.	
Alcohol (96 per cent) up to	300 "

Just before use, mix—

Solution No. I.	75 c. c.
Solution No. II.	30 "
Solution No. III.	30 "
Glycerine, chem. pure	20 "
Alcohol (96 per cent)	45 "

This eoside of silver solution is allowed to stand for one or two days and filtered, and 20 c. c. of it are mixed with each 100 c. c. of the raw emulsion. This dyed emulsion requires only about one-third of the exposure of wet collodion, but it keeps only one or two days. The glass plates, before being coated with the emulsion, are provided with the following substratum: 5 grammes of white gelatine are dissolved in 500 c. c. of distilled water, and to this solution are added 15 c. c. of acetic acid and 10 c. c. of alcohol. The solution is filtered at a temperature of 100° to 110° F., and while still warm, poured twice upon the plate. After being coated with emulsion, the plates are placed directly, without washing, into the dark slide, and can be at once exposed; they will, however, keep damp for thirty to forty minutes in not too hot a room. When exposed, the plates are washed by dark red light until all greasiness has disappeared, and allowed to drain in an upright position for some time. This draining must continue the longer the larger the plates are; if they are not sufficiently drained, streaks will be produced on the film during development. Development takes place by copiously pouring the developer over the plate, as in the case of the wet collodion process. The following concentrated hydroquinone developer is recommended as the best for this purpose:

Solution A.

Distilled water	500 c. c.
Sodium sulphite	200 grammes.
Potash	200 "

Solution B.

Hydroquinone	25 grammes.
Alcohol (96 per cent)	100 c. c.

Solution C.

Bromide of ammonium	25 grammes.
Distilled water	100 c. c.

The concentrated developing solution consists of:

Solution A	100 c. c.
Solution B	5 "
Solution C	7 "

In the case of hard negatives, solution B is increased to from 6 to 7 c. c. The actual developer is prepared by mixing:

Concentrated developer	150 c. c.
Water	1,000 "

The plates can be intensified with pyrogallic acid and silver by preparing the following two solutions:

Solution A.

Pyrogallic acid	7 grammes.
Citric acid	7 "
Distilled water	1,500 c. c.

When dissolved, add:

Acetic acid	25 drops.

Solution B.

Nitrate of silver	10 grammes.
Distilled water	100 c. c.

Just before use, 100 c. c. of solution A are mixed with 5 c. c. of solution B. If it is desired to intensify the plates after fixing, the same pyro. and silver intensifier may be gsed, but the hydroquinone and silver intensifier also answers very well. For reducing the negatives the hypo. and ferricyanide of potassium reducer, as used for gelatine plates, may be used.

Increasing the Sensitiveness of Asphaltum.—E. Valenta has found that the sensitiveness of asphaltum may be materially increased if it is incorporated with sulphur. He dissolves from 7 to 10 grammes of sulphur in a sufficient quantity of bisulphuret of carbon, and adds 100 grammes of Syrian asphaltum. The solution is then freed from the bisulphuret of carbon, and for about one hour heated up to 100° C.; it is then transferred to an air bath, and gradually heated up to about 180° C., until sulphureted hydrogen is escaping. At this temperature it is kept for about five hours. The asphaltum forms, after this treatment, a black and shining mass, which does not dissolve in alcohol, and only to a small degree in ether, while it dissolves perfectly in turpentine, benzole, chloroform, and bisulphide of carbon. Four parts of this preparation are then dissolved in 100 parts of benzole, and the solution is applied in the usual manner to a polished zinc plate. It form a light yellow, thin film of comparatively high sensitiveness to light, and gives, therefore, beneath a negative of good density clear and sharp impressions after the development with turpentine, even with comparatively short exposures.—*H. E. Gunther, in Photo. News.*

Lightning Conductors.

Dr. Hess, who has been collecting statistics and has examined the tips of many lightning rods, finds that fusion of the points never occurs. A fine smooth point receives the lightning in a concentrated form, while angled or ribbed, as well as blunt points, divide it into threads. Dr. Hess considers that platinum needles and tips are entirely unnecessary, for they have no advantage over copper points; but as there are lightning strokes which are capable of making wire 0·20 in. thick incandescent, unbranched copper conductors should never be of less diameter than this, though in a good lightning rod the main point is to secure perfect communication between it and the earth.

Rapid Progress of Electric Railways.

The address of President Watson at the recent Pittsburg meeting of the American Street Railway Association was a discussion of the present condition and prospects of the various methods of street railway traction and contained some valuable statistics. He said:

"It is a source of no little satisfaction to us to know that, in the development of the electric railway, America leads the world. Three years ago there were only 13 electrical roads in the United States; now there are over 400, and the advices from every part of the country indicate that before the close of the present year the number will be increased to 500. The capital now invested in American electric railways exceeds $75,000,000. 'Horse sense' counts for but little in this age of rapid transit. We old dogs have been obliged to learn new tricks, and without the usual privilege of serving an apprenticeship. Our stables are being converted into power houses; the electrician has taken the place of the veterinary surgeon; our drivers are being educated as motor men, and most of us have horse cars for sale.

"Our cities and large towns are becoming as hungry for street railways as the people of the West are for steam roads, and the bulletins of the new census reports show that in 54 of the largest American cities the mileage was nearly doubled between the years of 1880 and 1889, the figures being 1,983 miles in 1880, and 3,150 miles in 1889.

"The following statistics have been compiled from returns made by street rail way companies in the United States and Canada to the middle of September, and are believed to be as reliable as it is possible to make them:

Total number of miles	11,030
Number of miles operated by animal power	5,443
" " " " electricity	3,009
" " " " steam motors	1,918
" " " " cable	660
Total number of cars employed in street railway traffic	36,517
Number of cars operated by animal power	25,424
" " " " electricity	6,732
" " " " cable	3,317
" " " " steam motors	1,044
The number of horses employed	88,114
" " mules "	12,002
" " steam motors	200
Number of companies operating street rail way lines	1,003
" " " by animal power	537
" " " " electricity	412
" " " " cable	54
" " engaged in building new lines, about.	75

"It is interesting to note that since November, 1890, the number of horses employed on street railway lines has fallen from 116,795 to 88,114; that is, 28,681 in one year. At this rate, it will not take long to emancipate the horse from street railway business.

"According to the official figures taken from one of the street railway journals for the month of October, 1891, Philadelphia leads with 510 miles of single track; and after the Quaker City comes Chicago with 452 miles, New York with 289 miles, Brooklyn 285, Boston with 283, St. Louis 275, Baltimore 207, San Francisco 205, Cleveland 192, Cincinnati 180, Pittsburg 168, Kansas City 141, New Orleans 139, Louisville 132, Buffalo 110, Minneapolis 101, Los Angeles 99, Detroit 94, Birmingham, Ala., 92, St. Paul 90, Washington 85.

"The official figures of the census just completed show that in December, 1889, 476 cities and towns possessed rapid transit facilities; and it is now difficult to find any town of 5,000 inhabitants without one or more street railways.

"Since the introduction of cable and electric transit, the government, in its wisdom, has found a new use for the street cars. Some of our lines have been elevated to the dignity of United States mail routes. The plan, in bold outlines, is to place on all the cars convenient little boxes for the collection of mail, which is taken up and sorted at some central point and the city letters sent to the sub-stations, without any of the delays incident to the handling of the mails at a general post office. As an illustration of the workings of such a system there is on record a well authenticated instance of the travels of two letters, one of which was dropped into a letter box on a lamp post in a large city, and the other sent from the same point at the same time to the general post office on an electric car. A comparison of the envelopes subsequently made shows that the last named letter actually reached Washington, 400 miles away, at almost the same time that the letter dropped into the box was received at the general post office, only two miles away. In the city, where all the cars come to a common center, the plan seems most feasible, and companies who have not given this matter due consideration will do well to consult their local postal authorities at an early day."

Preserving Wire Ropes.

For preserving wire ropes carried under water or under the earth's surface a mixture of 35 parts of slaked lime and from 50 to 60 parts of tar is recommended. The compound is boiled and applied to the article hot. For dry-lying cables a thick mixture of graphite boiled in tallow, and one of crude linseed oil and vegetable tar, have both been tried with success.

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A TELESCOPE FOR SCHOOLS AND GENERAL USE.

The telescope shown in the illustration is designed and arranged especially for educational purposes, and, as will be seen, is mounted on a handsome and substantial equatorial stand, which is exceedingly portable and at the same time firm, supporting the telescope without the slightest tremor or vibration. The tripod is made of polished black walnut, and is so arranged that the legs can be spread out or closed, so as to accommodate the instrument to the height of the observer. It is also provided with a clamping device, which holds it securely in any position. The right ascension and declination axes are carefully ground and fitted, so as to secure smooth and uniform motion. Hence a star can be kept in the field of view by a simple movement in right ascension. Suitable clamps are also provided, by means of which any degree of friction can be placed on the axes; if necessary, they can be clamped tightly, each independent of the other. A balance weight is attached to the declination axis, so that the telescope is perfectly balanced in any position.

The tube is of brass, handsomely finished and provided with a fine, smooth-working rack motion for focusing. Each instrument is furnished with one erecting and four celestial eyepieces, giving powers from 75 to 280.

The object glass is a compound achromatic lens of full 4 inches aperture and 50 inches focal length, and is made in the most approved manner. It is guaranteed to show all the delicate test objects given in Webb's "Celestial Objects for Common Telescopes.

By this instrument may be seen the spots on the sun, the rapid formation and disappearance of which show the tremendous physical action going on in that great luminary; the mountains and their deep shadows thrown across the valleys on the surface of the moon, the evident result of fierce volcanic action in the distant past; the belts of Jupiter, demonstrating its very rapid rotation, and the four satellites of the planet alternately advancing and receding as they revolve about their great primary, exhibiting the phenomena of eclipses, transits, and occultations; the moons and rings of Saturn, which at the present time are in a most favorable position for observation, the rings being thrown with their surfaces toward the earth, thus giving a fine view of these most extraordinary appendages to the planet; the crescent of Venus, which increases and diminishes as it revolves about the sun, one of the most satisfactory proofs of the correctness of the theory of Copernicus; together with the asteroids, Mars, Uranus, Neptune, comets, various double stars, and nebulæ. Very fine terrestrial observations may also be had by using the erecting eyepiece.

The value of such an instrument in teaching and studying astronomy cannot be overestimated, as, in fact, a telescope is a necessity in the pursuit of this grand science.

In order to put this instrument within the reach of all persons its manufacturer, Mr. F. W. Gardam, of No. 58 Ann St., New York City, has spared no pains to perfect every part and to reduce the cost to the lowest possible figure.

A FOUR INCH EQUATORIAL TELESCOPE.

Armor Plate Trials.

Important and gratifying as were the results apparent at the recent tests of American armor on the Naval Ordnance Proving Grounds, other deductions of great interest and value have since been obtained through detailed investigation.

One thing which attracted attention was the irregularity of the penetrations in all three plates. Of two successive and similar projectiles fired at different corners of the same plate with exactly the same charge, from the same gun, one might enter more than one-third further than the other. For example, the first shot at the Bethlehem high carbon nickel plate, at the upper left-hand corner, showed a penetration of 13·25 inches; the second, at the upper right hand corner, a penetration of only 10·07; the third, at the lower left hand corner, a penetration of 13·90 inches; a fourth, at the lower right hand, a penetration of only 10·37. Differences of a fraction of an inch were, of course, looked for, but not differences of nearly four inches.

It was observed, in the instance just given, that these contrasts were presented by alternate shots, and further, that the first and third shots were about alike in penetration, while the second and fourth were also about alike and much less than the other two. In other words, the right half of the plate showed much more resisting power than the left. Similar inequalities were observed with the Pittsburg low carbon nickel plate of Carnegie, Phipps & Co., except that there one end showed greater resisting power than the other.

A study of these facts soon disclosed the reason for the lack of uniformity in results. The cranes used both at Bethlehem and Pittsburg for dipping the plates in oil were so slow in action that in the case of the Bethlehem plate one side was tempered harder than the other, while in the Carnegie plate one end was tempered harder than the other. It was, therefore, evident that hereafter the cooling liquid must be applied simultaneously to all parts of the plate. The quality noted in the best parts, as shown by the results, will then presumably become uniform throughout.

This principle was illustrated very strikingly in the all-steel Harvey plate, which had been sprayed with water on both sides. Being held perpendicularly between the two sprays, the discharged water from the upper portion of the spray, running down over the heated plate, was itself heated, and thus to a certain extent protected the plate from the chilling action of the lower portion of the spray. The upper part of the plate was distinctly harder than the lower, as shown in the trials, and, in fact, was the only portion in a proper condition for yielding the best results of the Harvey process.

The uniform chilling of a plate at all points of its surface will accordingly be the aim at both the armor-making establishments hereafter. But we must expect lack of uniformity in penetrations in the remaining plates to be tried. We may, indeed, look for better performances of the Harvey nickel plates furnished by both companies than that of the Harvey all-steel plate, since the nickel diminishes the tendency to crack. But these plates were alike tempered in the upright position, and subjected to the same unequal effects from the running water, with the consequence of unevenness in the hardening.

While these important gains in our ship armor even over the specimen plates tested at the proving grounds are thus assured, the comparison of the latter with the best European armor is gratifying. The Bethlehem high carbon nickel plate showed an average resistance to penetration, measured in inches, of about three inches less for each shot than the best plates furnished by France last year.

In the next place, the remarkably good performance of the Carnegie rolled plate, which doubtless can be improved upon with increased knowledge and experience on the part of the makers, would at once enable the Navy Department to quadruple the output of armor in a single year. The reason is that rolls like those used by the Pittsburg works can easily be set up in half a dozen places. Instead of waiting years for the necessary armor for our war ships, it could be turned out more rapidly than any other sort of war material. Another consequence must be a reduction in the prices of armor. Some steel makers have estimated that the prices will be brought down from $650 a ton to $350. Congress may therefore be more inclined to resume the construction of battle ships, now that it can no longer be said that the ships already under construction will engage the entire armor-producing capabilities of the country for several years.

Still another valuable result of recent studies is the conclusion that, in applying the Harvey process, both Bethlehem and Carnegie will probably try to introduce the carbon on one side of the ingot prior to any forging. This change alone, it is said, would save not only a great deal of time, but nine-tenths of the entire cost incident to the new treatment. In a new process of manufacture like this the successive stages of improvement depend on trials like those now going on. Yet the fullest and most successful development of the Harvey process may be expected within the next twelve months, and a year of further progress in naval armor making may also be looked for, possibly not less remarkable in its way than the one whose results are being shown at Indian Head.—*N. Y. Sun.*

Edison's Electric Railway Motor.

Mr. Edison has explained to the New York *Herald* his belief that the locomotive will be displaced on steam railways, and that his electric motor will be used instead. He said the economy would be large; he would get one horse power out of from one to two pounds of cheap coal, while the locomotive only got the same one horse power out of six pounds of dear coal. He intends to demonstrate that there need be no such thing as waiting for trains between cities now considered a long distance apart. He intends to run a train, say of two cars, every twenty minutes.

"I cannot go into details," said Mr. Edison, "for fear of injuring my rights on the other side—though, by the way, I never made anything out of European patents—but I will say briefly that the current will pass from the stationary engine to a central rail between the tracks, thence through the mechanism attached to the bottom of the cars or motor. A freight train, of course, would need a motor, because of the number of cars, although a single passenger car could be run carrying its own motor beneath it—thence to the wheels, and thence back by the side rails to the power house or stationary engine."

"And how many of these stationary engines would be needed?"

"Three of them, with a horse power of 10,000 or 12,000 each, would run the whole Pennsylvania railroad system between here and Philadelphia."

"Freight, local, express trains and all?"

"All of them, and at a great reduction of expense. Not only is each horse power produced at much less expense, but the depreciation of rolling stock and roadbed is much less. Every exertion of steam power is in the nature of an explosion, and when you take into consideration the fact that four or five hundred engines are on a road like the Pennsylvania at one time, each exercising a different degree of this explosive power, the depreciation is a great factor. But with electricity, it is always the smooth, rotary motion, imparted in the same way by the same men at the stationary engines."

"Can equipment be devised which will stand the strain of this system at full speed?"

The Wizard smiled. "Full speed of this system," he said, "is, or I see no reason why it should not be, 200 miles an hour. But as for practical purposes, I feel sure that a 100-pound rail on a rock-ballasted track would stand the speed of 100 miles an hour."

Whitened Cape Diamonds.

It is stated that artificially colored diamonds have been sold lately in Belgium. A French chemist finds out that on being dipped in a weak aniline solution the diamonds lose their yellowish tinge, and appear as pure white as the Indian or Brazilian stone. The aniline can neither be seen by a magnifying glass nor rubbed off with a chamois leather; so Mr. Guillot thinks that the dye must lodge in the sharp angle of the facet which remains unpolished, and so affect the light as it falls on the flat surface. A bath of nitric acid will show the fraud, or a little alcohol, which M. Guillot recommends diamond merchants to use for testing.

THE STEAM JET PUMP, made by the Van Duzen & Tift Co., of Cincinnati, Ohio., has been for many years before the public, and is in successful use in nearly every country in the world where steam pumps are used at all, and for the widest possible variety of service. It is extremely portable and compact, requiring little skill to set it up or take it down, and it costs but very little for maintenance and repairs, and requires neither oil nor packing. The same company also manufacture other specialties for steamboats, machine shops, factories, mills, tanneries, etc., including a sensitive loose pulley oiler and a variety of water gauges, and they are also the proprietors of the Buckeye Bell Foundry, established in 1837.

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RECENTLY PATENTED INVENTIONS.

Engineering.

LINK VALVE GEAR.—William A. Winn, White Hall, Ill. The link is, according to this invention, pivoted near its middle with the reversing mechanism, and is formed with a slot arranged in line with the draught, the link block being fitted to slide in the slot and pivotally connected with the valve stem connection, while eccentric rods are pivotally connected with the sides of the link at its upper and lower ends. The link block has a U-shaped flanged body part carrying the wrist pin for the valve stem connection, and a cap for holding and adjusting the body part in the link, the improvement being designed to reduce friction and strain to a minimum, and facilitate the convenient adjustment of the several parts to compensate for wear.

ENGINE TENDER SCOOPS. — Caleb N. Devinney and Simon Hafner, Philadelphia, Pa. This invention provides a mechanism for automatically raising the scoops when the tender tanks are filled. A float piston is located within a dome constructed on the tank, and there is a rod and lever connection between the float piston and the lifting device of the water scoop, whereby the latter will be raised when the tank is filled. A mechanism is also provided whereby the engineer or fireman may, by means of compressed air, quickly raise or lower the scoop independently of the automatic apparatus, the improvement being designed for ready and inexpensive application to any tender, to be connected with an ordiuary scoop.

FURNACE. — Absalom Backus, Jr., Detroit, Mich. This furnace has an arch connected with the top of the bridge wall and extending within the fire chamber some distance over the grate, there being an opening beneath the arch between the grate and the bridge wall, the opening being provided with dampers operated by a special mechanism The construction is such that the arch serves as a superheater, adding to the intensity of the heat below the center of the boiler. The air admitted is under perfect control, and the heat is designed to be directed against the boiler throughout its entire length, the improvement being adapted to insure perfect combustion and economy of fuel.

Railway Appliances.

CAR SIGNAL. — Mahlon A. Gerber, Mahony Plane, Pa. The signal designed by this inventor is more especially adapted for use on freight trains, to enable the rear brakeman to signal to the engineer. The car or caboose in which the signal is located carries an air pump and reservoir, the pump being so connected with the axle that the reservoir will be kept full of compressed air by the motion of the car. The reservoir has a safety valve and a gauge, and is connected with a whistle at the top of the car, whereby the whistle may be blown by the brakeman or conductor whenever necessary. The pump can be worked by hand to supply compressed air to the reservoir when the car is at a standstill.

AUTOMATIC CAR DUMP.—John Story, Lonaconing, Md. Mining work is the especial object of this improvement, devices being provided whereby, as the loaded cars travel down to the dump, they will have their gates first automatically unlocked, when the car will be dumped and switched by gravity to another track for return to the mine. A tipple section of track is arranged at the intersection of two track sections, both on a down grade, but running in reverse directions, and the triple section is pivotally supported in such manner as to engage the loaded car passing down from one track, tilt it, and at the same time shift the section to come in line with the other track section, as the car falls back in position after discharging its load, to admit of its return to the place of filling.

RAILWAY TRACK BRAKE.—This is another patent of the same inventor for a brake which shall be disconnected from the cars on which it acts, and may be made act successively on all the cars. The improvement consists of one or more horizontal brake bars arranged parallel to the track and just above the rails, while swinging links are pivoted at one end to the brake bars and at the other end to a fixed support, with means for giving the bars a parallel motion. This brake is adapted to clamp the edges of the wheels as they pass along, to retard the momentum of the car or stop it altogether.

CAR BRAKE. — Augustus J. O'Neill, Butte City, Montana. This device is more especially designed for use on cable roads. Combined with a plate adapted to extend into the slot of the cable conduit, and having brake shoes to engage the conduit, is an arm pivoted on the brake and carrying the pivot of the plate, the arm being under the control of the operator, while bell crank levers are pivotally connected with the arm and links are pivotally connected with the bell crank levers and the plate. The brake is of simple and durable construction, and has the superior advantage of holding the car to the track when braked.

Mechanical Appliances.

CENTRIFUGAL FORCE PUMP.—Edward S. Nicholas and Joseph R. Turner, Greenville, Ohio. In this pump a hollow revoluble inverted duplex cone is mounted to turn near the top of and within a casing which combines a water receiver and an air chamber. The construction is designed to be simple and durable, and to reduce friction to a minimum, so that the motive power employed is utilized to the greatest advantage.

SAWING MACHINE. — John B. and James P. Coan, Vincennes, Ind. In an adjustable frame is mounted a rocker supporting a platform and seat for the operator, while handles are connected with levers whereby the platform may be caused to rock backward and forward, the operator following with his body the motion imparted to the levers. The front end of the platform has a head pivotally connected with the saw, which is thus operated to cut logs, etc.

COTTON GIN FEEDER.—Ralph Hathaway, Memphis, Tenn. This invention consists of a lever controlled from the gin lid and controlling the feed pawls of the feed roller. When too much cotton has been fed into the gin, the speed of the roller is automatically reduced about one-half, while in case of an obstruction in the gin the feed is stopped entirely, being set in motion again when the surplus cotton has been worked off. The improvement constitutes a simple, durable and effective feeding mechanism.

WRENCH. — Cicero T. Hammack, Birmingham, Ala. This wrench has two fixed jaws, and in one side of one of the jaws is a dovetail recess from which an opening extends through to the outside of the jaw. An auxiliary jaw with a dovetail tongue is adapted to fit in the recess and be locked in position there by a fastening device. By having a set of such auxiliary jaws the wrench is readily adapted to all classes and kinds of work.

Agricultural.

MOWER AND REAPER.—Tom. O. Sundet and Salve W. Brekke, Neilsville, Minn. Combined with the frame and cutting apparatus is an operating wheel rigidly mounted on the axle, a tubular sleeve capable of longitudinal movement being also mounted on the axle, while a vibratory lever is pivoted to the tubular sleeve and adapted to be moved in and out of engagement with the operating wheel. The mechanism is exceedingly simple and easily operated, and is designed to give powerful leverage and insure lightness of draught.

FRAME FOR MOWER AND HARVESTER.—Samuel M. Pryor, New Castle, Ky. This improvement is more especially designed for a front cut reaper and mower, to take the place of the usual heavy and cumbersome frames now employed. The improved frame is simple and durable in construction, and easily built, while it is so made that the various parts of the machinery may be easily attached to it, means being also provided for placing the machine under the easy control of the driver.

COTTON CHOPPER.—Henry P. Tobin, and March Holman, Allendale, S. C. A gear wheel held to turn on the axle rotates a disk provided with radial cutter carriers, supporting cutters arranged diagonally to the axis of the disk, the blades revolving as the machine moves forward to thin out the plants. One or more covering plows are secured to rearwardly extending beams for turning up the soil, and the machine is designed to be simple, inexpensive, and very effective in operation.

Miscellaneous.

GYROSCOPE. — George E. Sire, Besancon, France. This is a simple device which may be used as a scientific toy and as an instrument of mechanical demonstration. It consists of a block having a central recess and a grooved face, a suspension cord being secured in the grooved portion of the block while an axis carrying a disk is pivoted in diametrically opposite sides of the recess.

COVER FOR SAP PAILS.—Titus Stowe, Readsborough, Vt. This cover has a supporting and attaching device, formed of a single piece of wire, whereby it may be readily placed in the desired position on a tree, and swung down to cover the pail or swung up for inspection or when the pail is to be removed. It is designed to protect the sap collected within the pail or bucket from rain, dust, dirt, etc., or from exposure to the sun.

ADDING MACHINE.—Joseph E. Blackshaw, Pittsburg, Pa., and George H. Rogers, Birmingham, Ala. This is a simple and compact machine, adapted to readily add small or large sums. Within a circular metal casing pivoted on a base plate is a ring graduated on its outer edge with divisions representing hundreds and on its inner edge with units up to a hundred, while a central toothed disk has graduations and teeth corresponding to those on the inner edge of the ring, there being means for rotating the disk, and an index hand at the outer circumference of the ring, gears connecting the disk to the index hand. The adjusting or counting arm is centrally pivoted, and bent up to form a handle and then outwardly, having a rocking spring action in entering or withdrawing its tooth from the notches of the disk.

CALENDAR. — George H. McKee, Darlington, S. C. A casing made of two hinged sections contains this device, one of the sections containing a stamp box or compartment, while the other has a main dial, a mouthplate, and a lock dial and detent. The device is designed to be carried in the pocket, and to enable the user to quickly determine the day of the week of any date in the period comprehended in the calendar, while it at the same time furnishes means for conveniently carrying postage stamps, etc.

EDUCATIONAL TOY. — Milton H. Rowland, Gladstone, Mich. A toy sled, wagon, chair, or other suitable base, has the letters of the alphabet and Arabic numerals marked on it, and perforations are made through the characters to receive different colored pegs or pins, which may be arranged to mark out words and indicate numbers, the device being also employed as a toy.

ALBUM.—Bernard Branner, New York City. This album is adapted to open oppositely and is centrally supported to revolve on a fixed shaft, while a folding picture holder has a hinged and a swiveling connection with a folding album case. The invention is an improvement on a former patented invention of the same inventor, providing additional novel features for the album and supporting frame, whereby the device is rendered more convenient and the exhibition of the contents of the album is facilitated.

MUSICAL INSTRUMENT.—William Van Deventer, Tacoma, Washington. This invention provides a tail piece for stringed instruments which is simple and durable in construction, and permits of conveniently and quickly attaching or detaching the strings. The tail piece has on its upper end a series of J-shaped slots, the several slots forming projections on which are fastened the ends of the strings, which can thus be quickly and securely fastened and are readily removed to replace a worn out string by a new one.

DERRICK.—Charles E. Swift, Tonica, Ill. This is a strong and simple construction more particularly designed for conveniently hoisting and setting various structures, such as towers for windmills, electric lights, etc. It is adapted to be readily set up near the structure to be hoisted, and has a suitably constructed base on the front end of which are bearings in which is journaled a cross piece supporting in its middle the derrick boom. The boom is preferably made in several sections spliced together, and is strengthened by a series of plates arranged one above the other and connected with each other by truss rods.

WEIGHT RELEASING DEVICE.—Elias B. Birge, St. Paul, Minn. This invention provides an improvement in mechanism for opening or closing doors of fire engine houses, etc. A plate on a side wall supports a pipe into which projects an arm of a catch lever, a bar in the pipe supporting at its lower end a weight and the upper end of the bar being engaged by the catch lever, there being also attached to the weight a rope connected with a sliding bolt or other fastening for the door to be opened. A trip wheel actuates the lever mechanism for releasing the weight.

RANGE BOILER. — Ira G. Lane, New York, and Arthur H. Lovejoy, Whitestone, N. Y. The boiler is supported by brackets at the ends and near the back of the range, and is inclosed by a vertically swinging cover. One of the brackets has two bores connecting with the boiler at the top and with the water back, the connection being very simple and such as to insure a free circulation of water, while the boiler and the connections are entirely concealed, the boiler also assisting to heat the hot air closet located between the brackets.

LAMP BURNER.—Charles Pabst, Philadelphia, Pa. A wick suspending and adjusting device is provided by this invention, consisting of a pair of spring arms having integral lateral projections at their free ends, and a cross bar pivoted for limited vibration in the projections, the cross bar having pointed fingers, and the fingers and arms extending in parallel planes. The device is designed for use with burners in which a flat wick is used, facilitating the adjustment of the wick, and affording improved means for increasing the oil feed of the wick when in service.

LATCH. — Benjamin Edwards, New York City. This latch has a sectional casing, in which is a spring pressed bolt having lugs at each side, while the follower has a cam projection and a guide block secured in the casing and projecting partially over the follower, with other novel features. The latch is designed to be simple, durable, and inexpensive to make, having but few parts and operating with very little friction.

TRANSOM LIFTER. — Robert F. Hatfield, New York City. This is a simple device by means of which a laterally or horizontally swinging transom light may be held or locked more or less fully open as desired, the device also assisting in holding the transom light closed. It consists of an upright rotatable rising and falling rod applied to the casing, and having an upper radially bent branch arm in connection with the transom light in front of its hinges, there being a fixed spring catch to receive the branch arm when the rod is lowered.

ROAD CART. — Annie R. Chittenden, Osceola, Iowa. This invention relates to a two wheeled vehicle, to the axle of which are secured bars having their rear ends bent upwardly and outwardly, while a spring secured to the rear part of the seat and foot box support is connected to the ends of the bars by link connections, a spring secured to the foot box also having its end connected the bars by link connections. The construction is simple and durable, and is designed to support the weight of the occupants on the axle, relieving the animal of all strain and obviating the disagreeable jar frequently found in carts as now constructed.

HORSE ARRESTER. — John Siebel, Oskaloosa, Iowa. This is a simple and inexpensive device for application to wheeled vehicles to automatically arrest an animal standing hitched to the vehicle if the animal attempts to start or run away, obviating the necessity for hitching the horse to a post, or the use of a heavy weight attached to a halter. A toothed wheel is formed on the inner end of one of the wheel hubs, and a gear segment adapted to engage the toothed wheel has an upwardly extending bar carrying a fork or loop to which the driving reins may be secured. A cam lever is pivoted on the side of the bar, and a downward movement of its handle causes the gear segment to engage the toothed wheel on the hub.

ANIMAL TRAP.—Hans H. Thiellesen, Custer City, South Dakota. This trap consists of a receptacle having a counterbalanced trap door in its top, there being a mirror above the downward swinging end of the trap door, and a perforated bait box in front of the mirror, open at its inner end to permit its contents to be reflected in the mirror. The trap is arranged to reset itself after an animal is trapped.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE HISTORY AND DEVELOPMENT OF STEAM LOCOMOTION ON COMMON ROADS. By William Fletcher. London: E. & F. N. Spon. 1891. Pp. xv, 288. Price $3.

The history of the traction engine in this work is divided into the following periods: The periods of speculation, of experiment, of successful application, and finally the modern period. An introduction gives the early history of steam traction, and a chapter toward the end of the book gives practical notes on the design and construction of road locomotives. The work contains such an amount of interesting matter that our room is not enough to adequately review it. It will be of peculiar value at this day, when the spreading movement for good roads makes the road traction engine a near possibility in this country. The English law practically prohibits them, but even in England they are made for export to foreign countries and to the English colonies.

ESSENTIALS OF BACTERIOLOGY. By M. V. Ball, M.D. Philadelphia: W. B. Saunders. 1891. Pp. 159. Price $1.

This work, although nominally one of a series of quiz compends, really makes an excellent presentation of its subject. It is designed especially for use by the medical student, but from its low price, numerous illustrations, and generally attractive style, will have many other readers. The subject of bacteria culture is of fascinating interest, and popular manuals like the present will do much to extend its study.

COMMON SENSE IN MAKING AND USING STEAM. Facts for the consideration of proprietors of steam plants, by one who has paid for his experience. The Mason Regulator Company. Boston, Mass. 1891. Pp. 60. Price 25 cents.

This little work, so graphically described in the title page, is due to Mr. W. H. Bailey, M.E., of Rochester, N. Y. It treats of all the generalities of the steam plant, its location, boilers, their qualities, and care required to preserve them, grate bars, furnaces, fuels, the engine, indicator cards, and by no means least interesting, the management of firemen and engineers. The work concludes by a section on convenient rules, tables, and facts, and brief items of useful information. A six-page index sets a good example to more pretentious manuals. It is sufficient to say that the subject is attractively treated, and we are sure will prove entertaining as well as useful reading to many mill owners and others interested in getting most power out of coal or liquid gaseous fuels.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER NUMBER.—(No. 73.)

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1. Colored plate of a very attractive cottage erected at Asbury Park, N. J. Cost $2,500. Perspective elevation, floor plans, etc.
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3. A cottage at Plainfield, N. J. An excellent design. Plans and perspective. Cost $6,500 complete. Messrs. Rossiter & Wright, architects, New York.
4. A neat cottage at New Dorp, Staten Island, N. Y. Cost $3,300 complete. Plans and perspective.
5. A handsome cottage at Rochelle Park, N. Y., erected at a cost of $10,000. Perspective elevation and floor plans.
6. Plans and elevation of an attractive dwelling at Asbury Park, N. J. Cost $4,300 complete.
7. A model cottage at Chester Hill, Mt. Vernon, N. Y. Floor plans and perspective view. Cost $4,000 complete.
8. Perspective and plans of a cottage at Fordham Heights, N. Y. Cost $5,800 complete.
9. A cottage recently erected at Asbury Park, N. J. Cost $2,700 complete. Floor plans and perspective.
10. Perspective view of the residence of Mr. H. P. Rugg, St. Paul. Mr. A. H. Stern, architect, St. Paul.
11. Perspective and ground plan for a memorial church.
12. Accepted design for the completion of the South Kensington museum, Ashton Webb, architect.
13. Miscellaneous contents: Clover honey.—Fire precautions in building.—What taste with a little money may accomplish.—Wrought iron gate, illustrated.—Plan designing.—Simple precautions against fire and rats. — Floor painting.—The Japanese house. — The Postmaster-General's bricks.—Architecture in relation to hygiene.—Fireproof buildings.—Some novel effects in paper hangings, illustrated.—An improved woodworking machine, illustrated. — An improved mechanical stylus, illustrated.—An improved tenoning machine, illustrated.—An improved swing cut off saw, illustrated. — The Byrkit-Hall sheathing and lath, illustrated.—Power hack saw, illustrated.—An improved dumb waiter, illustrated.

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Business and Personal.

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For Sale—28" x 12' and 32" x 16' engine lathes. New, with compound rest and power cross feed. W. P. Davis, Rochester, N. Y.

Acme engine, 1 to 5 H. P. See adv. next issue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Best 15 in. Shapers, $245. Am. Tool Co., Cleveland, O.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Beach's Improved Pat. Thread Cutting and Diamond Point Lathe Tool. Billings & Spencer Co., Hartford, Ct.

Centrifugal Pumps for paper and pulp mills. Irrigating and sand pumping plants. Irvin Van Wie, Syracuse, N. Y.

For Sale—A vacuum pan, a digester or converter, a still. All copper. Apply to J. Edw. Crusel, New Orleans, La.

For Sale—Patent 445,891, Cotton Scraper. New and valuable. Send 2 cents for circular. Jas. Hobbs, Lagarto, Texas.

Wanted—Machine for cutting old style through dovetail to lock boxes. Address Boxmaker, care of Scientific American.

Scale removed and prevented in boilers; for each 50 horse, 10 cents a week. Pittsburgh (Pa.) Boiler Scale Resolvent Co.

Have mill and power. Want to associate with one having patented article to manufacture. Address "B.," care Scientific American.

For Sale—A quantity of scrap rosewood, averaging in size from 1¼ to 1½ inches diameter, of various lengths. Address The James Cunningham, Son & Company, Rochester, N. Y.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

Wanted—A first class man as assistant to superintendent of motive power, to take charge of railroad engine shops. Address, stating age, references, and salary expected, to J. M. C., care Scientific American.

☞Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Automatic Springless Door Latch. Patent for sale entire, or arrangements made to manufacture on royalty. Patent dated Nov. 10, 1891. See page 339. Address for particulars T. C. Mace, Cameron, Mo.

The Akron Iron Company, of Akron, Ohio, have recently issued a new catalogue (for their Eastern department) of shafting, pulleys, friction clutches, and other power transmitting machinery. As a special feature, it contains numerous millwrights' tables and other technical information that is of interest and value to superintendents, engineers, and machinists. These special features make this catalogue well worthy of preservation as a handbook on the subject of power transmission. It is furnished with special indexes to facilitate quick reference. A copy will be furnished upon application to Akron Iron Company, Akron, Ohio, *providing this paper is mentioned.*

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(3674) V. E. H. asks: How are spiral brass springs made to hold their temper? A. Spiral brass springs cannot be recuperated. Get new ones when the old weaken.

(3675) F. P. C. asks for the formula for the so-called eggs of Pharaoh's serpents. A. See our SUPPLEMENT, No. 259, for the original formula, which gives off injurious vapors. To avoid this another formula gives potassium bichromate 2 parts, potassium nitrate 1 part, white sugar 3 parts. Pulverize each ingredient separately and mix without further pulverizing. Enclose in little paper cones. Do not inhale the dust in pulverizing the potassium bichromate.

(3676) H. H. G. asks for the cheapest as well as the least complicated way of making fuel gas on a small scale. Also the material used in the making of the gas. A. It is made by blowing air and steam mixed through incandescent coal. Either anthracite or bituminous coal may be used. Sometimes the air and steam are blown alternately, the products of the air blast being allowed to escape. This gives a gas of more intense heating power. You will find articles on the subject in our SUPPLEMENT, Nos. 276, 278, 531, 654, and many others.

(3677) E. B. N. asks: What solution that will be a cheap and good one can be used to clean dirt off from geological specimens and that will not injure the specimens? A. It depends on the nature of the specimens and of the dirt. Good soap and water with a scrubbing brush, or a wire brush such as foundry men use, are available.

(3678) E. D. asks for the composition of the substance on the trick matches inclosed; when struck a slight explosion takes place and the flame is extinguished. A. It is a compound of silver, probably fulminate, gummed to the match.

(3679) W. O. B. asks: How can I purify and make into the solid state a solution containing nitric and hydrochloric acids and pure gold leaf, in order to use the same as a tanning solution for photographic prints? A. Evaporate nearly to dryness, add more water and re-evaporate, and repeat until it is neutral in reaction. If you evaporate to full dryness, there is danger of producing a basic salt.

(3680) G. H. asks: 1. How is gasoline gas made for illuminating purposes? A. Gas can be made from gasoline by passing air over its surface. The air takes up enough of the vapor to burn. The temperature of the gasoline tends to fall on account of the absorption of heat by the evaporation; hence the apparatus should be kept at a constant temperature as far as possible. 2. Is the gas referred to very dangerous? A. No; it is used in a great many country houses with success. 3. Is the gas very easily blown out. If so, is there any protection for the light? A. It is more easily extinguished than pure coal gas. It is burned in Argand burners with chimneys or in special open and unprotected burners. 4. Has heat or cold any effect on the light? A. Heat would tend to improve it, and sufficient cold might by condensing the gasoline in the pipes extinguish it. Under ordinary conditions it gives no trouble. 5. What is the cost of gasoline light per thousand feet? A. No figure can be given, as the gas is not measured. It is a cheap form of illuminant.

(3681) S. A. A. asks how to make a gold plating solution (the best), how to couple and use it with my dynamo which I made like that described in SUPPLEMENT, No. 161, only with the drum armature. Field is wound with No. 16 and armature with No. 18 double covered magnet wire. It works well. I would like the solution and connections fully described, so I can make it myself. I am a practical watchmaker and a subscriber. A. For information on plating solutions we refer you to SUPPLEMENT, No. 310. A dynamo wound as you have it is not suitable for plating, as it gives a current of too high an E. M. F. Probably an armature wound with No. 10 or No. 12 wire would answer. Consult SUPPLEMENT, Nos. 720 and 793, for information on small plating dynamos.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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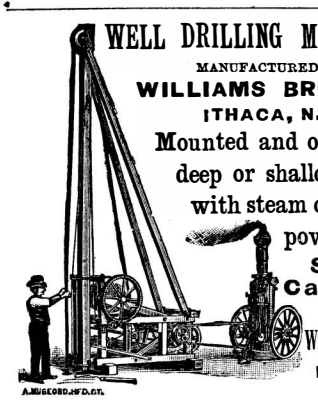

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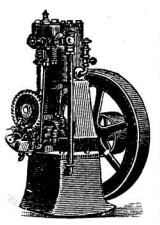

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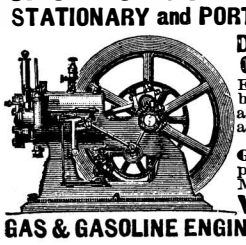

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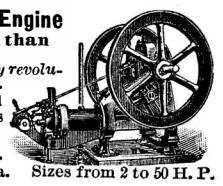

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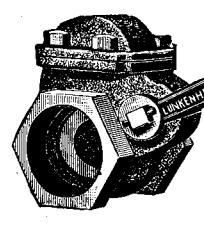

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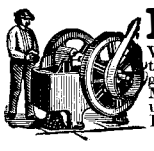

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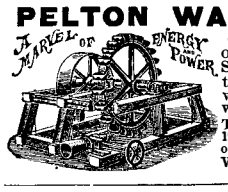

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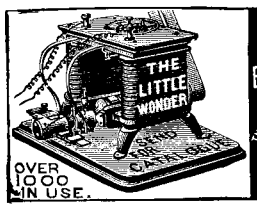

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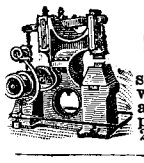

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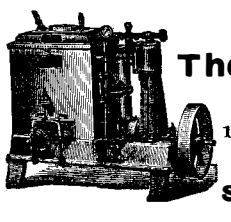

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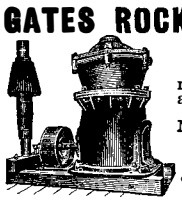

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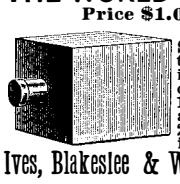

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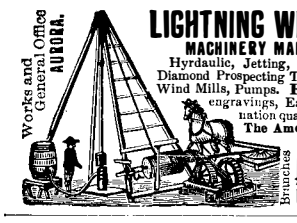

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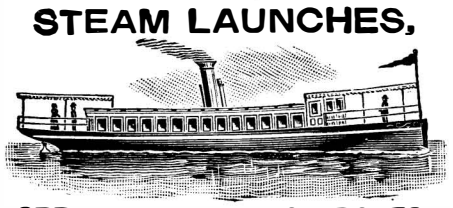

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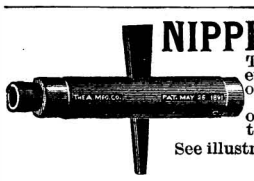

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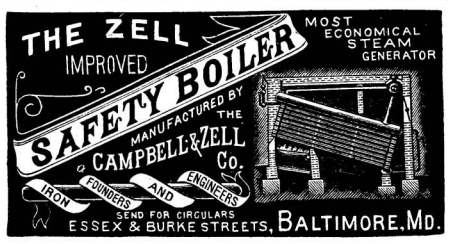

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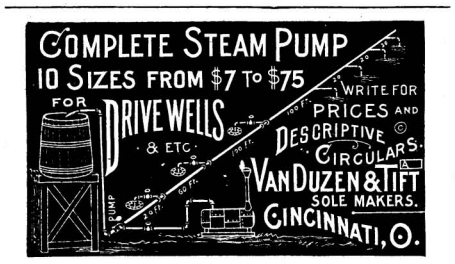
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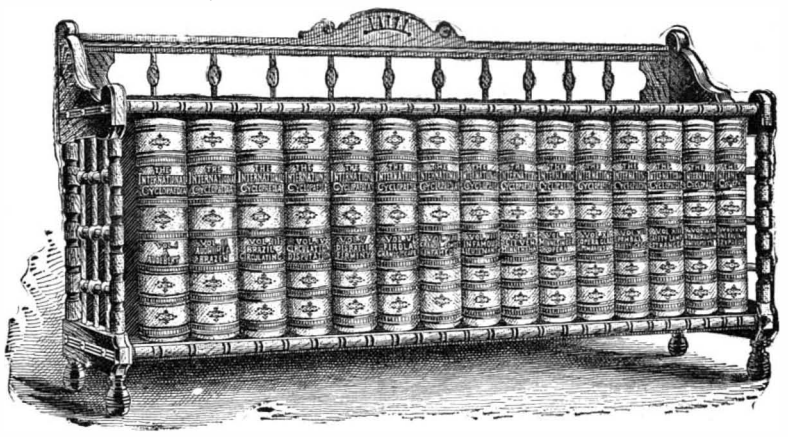

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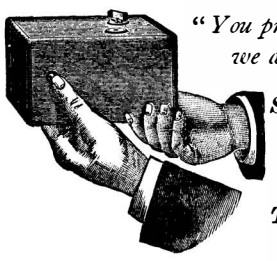

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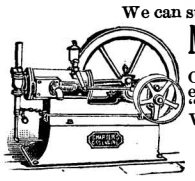

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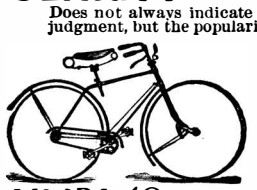

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